THE MARINE REVIEW

VOL. 38. CLEVELAND, AUGUST 27, 1908. NEW YORK No. 9

MODERN ORE HANDLING MACHINERY.---II.

BY WALTER G. STEPHAN.[1]

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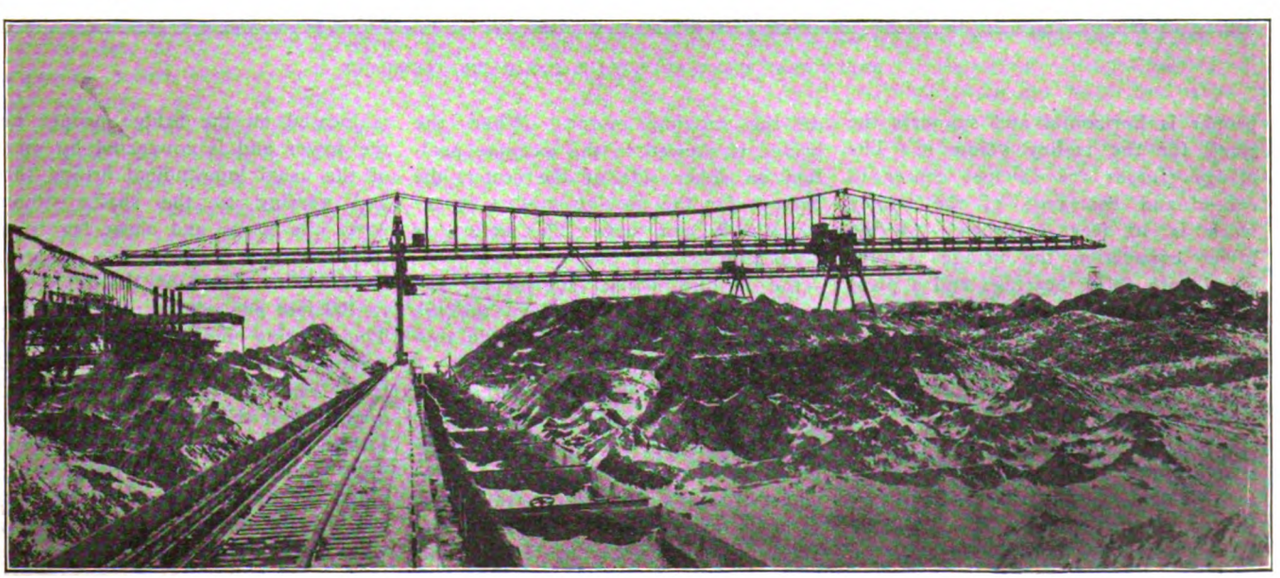
[1]Consulting mechanical engineer, Citizens building, Cleveland.



BROWN ORE BRIDGE, PITTSBURG & CONNEAUT DOCK CO., CONNEAUT.

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As is customary in all modern plants, the unloaders at the face of the dock drop the ore from the hold of the boat into a U-shaped concrete trough at the rear, from which the bucket on the ore bridge picks it up and carries it to the stock pile. The cantilevers from the unloaders overhang the U-shaped trough and the bridge cantilever overhangs the cantilevers on the unloaders.

The new bridge is designed to run on the same tracks as the old one and its main span is 250 feet 3 inches center to center, with cantilevers at either end 157 feet 5¼ inches long—making a total length over all of more than 565 feet. The extreme travel of the bucket is 530 feet.

The bridge is supported on a tower at one end and a shear leg at the other end. Its total weight is about 625 tons. The tower travels on two double rail tracks 32 feet center to center, the rails being laid on two

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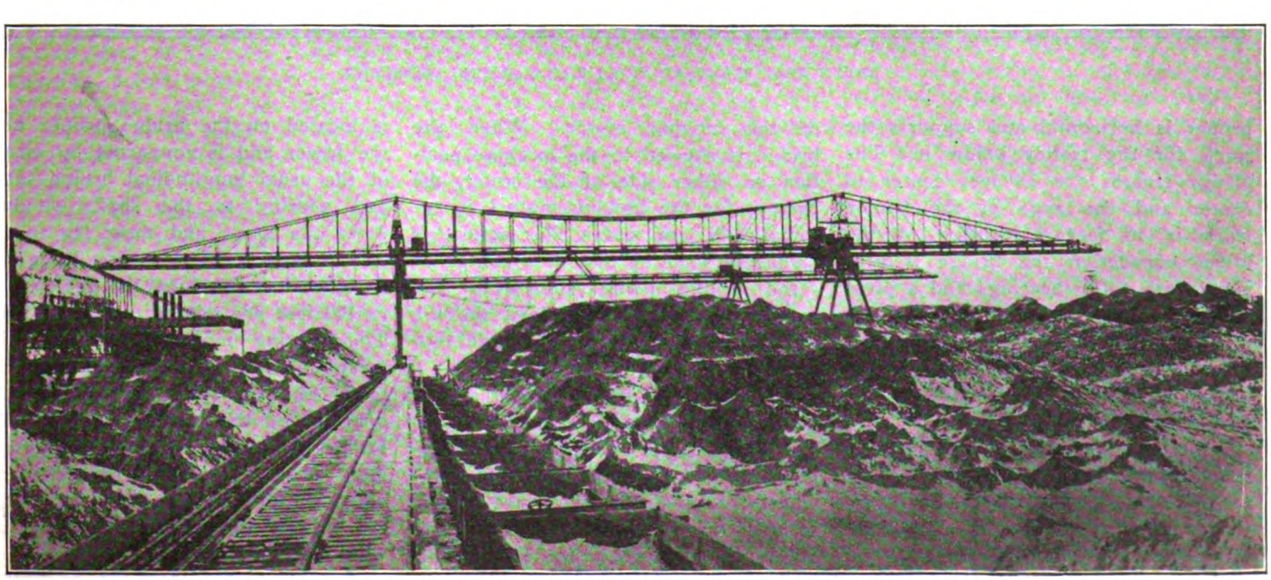

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concrete piers 12 feet 5¾ inches above the dock level, leaving space between the piers for two standard gage tracks for ore cars. The tower rests upon four equalized four-wheel trucks—all of them driven.

The shear leg rests upon two eight-wheel equalized trucks—of which only half of the wheels are driven. The wheels travel on a double rail track 36 inches center to center which is mounted upon a wooden trestle of the same height as the concrete piers at the tower end.

The lower chord of the bridge proper is horizontal and supports the track for the trolley below it. The bridge trusses are 18 feet center to center and the gage of the trolley track is 10 feet 4 inches. At the tower connection the bridge is provided with roller bearings and a pivot while the connection to the shear leg is a ball and socket joint. This provides for a maximum skew in the bridge of 1 in 9, either side of the normal position.

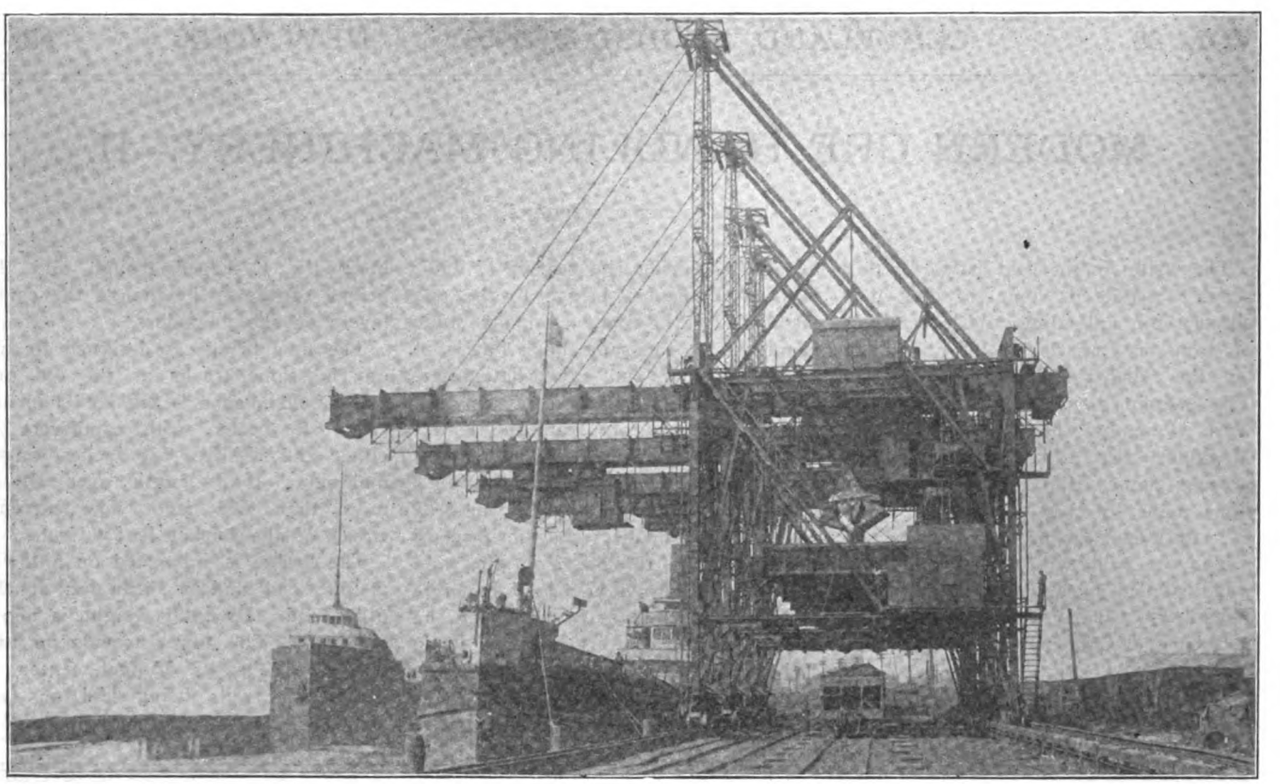
Interesting features in this connection are the devices designed to prevent skewing beyond the extreme positions allowable. One is a mechanical device which consists of a system of levers and rods on both the tower and shear leg by means of which a notched casting is gradually forced down upon the track rail to prevent further skewing, as the bridge is swung out of its normal position. The lever system is carried from the locking device at the rail, up the tower or shear leg to the bridge to which it is finally fastened. As the bridge swings, the relation between it and the shear leg or tower varies and this relative movement operates the locking device at the rails below. The second safety device to prevent over skewing is electrical and consists of an electrical cut out located at the top of the tower which is in the circuit of the moving motor. When the bridge is skewed to the extreme position on either side of the center, the current for the moving motors is automatically cut out. The action is much the same as that of a controller—the bridge being considered the handle of the controller, and the arc of contact being twice the angle represented by a skew of 1 in 9.

The bridge is provided with a man trolley which operates a Brown standard 10-ton grab bucket. The trolley is mounted on four equalized two-wheel trucks all of which are driven. It is of the standard construction and allows the operator to handle his bucket either lengthwise or at right angles to the trolley track.

The weight of the trolley is about 41 tons and of the bucket about eight tons. All of the operations on the bridge are electrical, and all of the motors were made by the Ellwell Parker Co., Cleveland.

The two hoist motors on the trolley are rated at 200 horsepower and are designed to hoist the bucket at a speed of 250 feet per minute. The two trolley travel motors are designed for a speed of 1,000 to 1,200 feet per minute and are rated at 75 horsepower.

The 150-horsepower moving motor is located on the bridge proper near the tower and is connected by means of the usual longitudinal bridge shaft, and gearing to the shafts running down the tower and shear leg to the driven trucks. The entire bridge is designed to travel at the rate of 50 to 100 feet per minute under full load. The moving motor is operated by master controllers located at both the tower and the shear leg, so that the operator on the trolley can move the bridge by running to either end of the main span. A solenoid brake is provided on the moving shaft by which the bridge moving mechanism is always locked except when current is sent through the moving motor. Rail clamps are provided on both bridge tracks by which the machine is se-



BROWN FAST PLANT AT N. Y., P. & O. DOCKS, CLEVELAND.

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curely clamped to the rails when not in use.

At the top of the tower, a swinging crane is provided for the purpose of handling the machinery in the trolley, whenever this is necessary. The trolley is provided with air brakes and also solenoid brakes for additional safety. The bucket has a spread of about 15 feet 1½ inches and a width of about 6 feet 8 inches. In a test run made some time since, it averaged over nine tons per bucket.

The clearance of the bucket above the dock level is about 52 feet and the capacity of the ore pile contained between the tower and shear

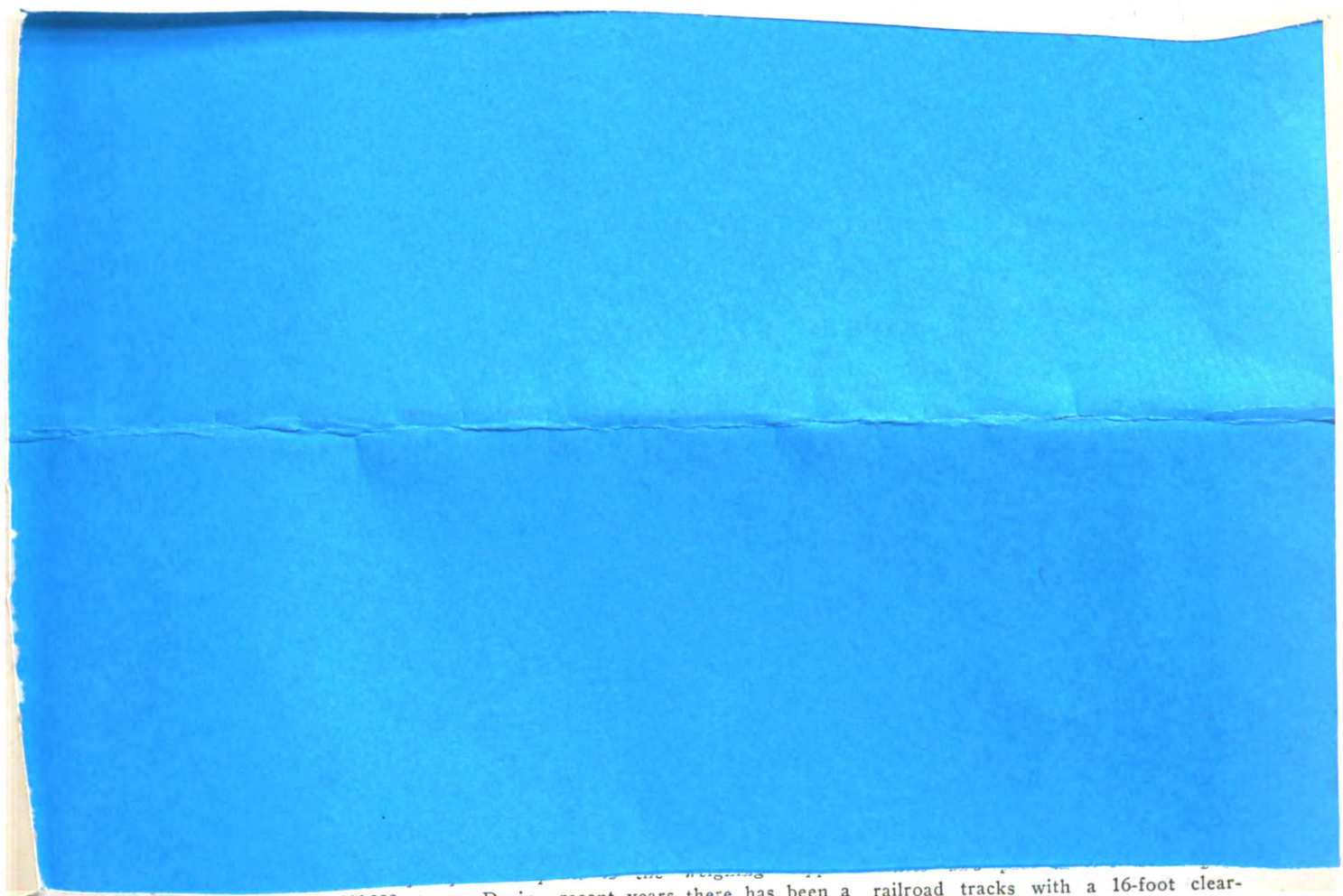
ing protected by vertical boards running lengthwise between them.

A BROWN FAST PLANT.

Perhaps the latest and most complete ore unloading plant installed by the Brown Hoisting Machinery Co. is the one shown in Fig. 2 which consists of four machines erected during the early months of 1907 at the ore docks of the N. Y. P. & O. R. R. at Cleveland. These machines were designed to unload ore from lake boats directly into railroad cars. No provision is made for unloading into a trough or stock pile at the rear of the machines as is done at Conneaut and Fairport, where the same type

to be loaded above or below the allowable 10 per cent excess, such an amount of ore had to be taken out by shovels in the best way possible, before it was allowed on the road. This method resulted in numerous delays and re-weighings and it was to avoid them that weighing the ore, as it is delivered to the car from the hopper, was suggested. The problem was put up to the designers of ore handling machinery and the above plant is one of the satisfactory solutions which have been offered by them.

All of the four machines illustrated are alike. Each is designed to handle a standard 5-ton Brown grab



under the cantilevers) 666,000 tons. The bridge is designed for a capacity of 425 tons of iron ore delivered from the U-shaped pit to the middle of the span per hour. The fact that the front cantilever of the bridge overhangs the unloaders at the face of the dock is taken advantage of in the handling of machinery for repairs, etc., on the unloaders. Current is supplied to the machine at 220 volts from conduit rails running alongside of the shear leg runway rails, the two conduits be-

During recent years there has been a growing demand among ore shippers for a satisfactory weighing device which would eliminate the delays occasioned by the weighing of the loaded cars on separate scales. In the past, a man called the car guesser had to estimate as nearly as he could, the amount of ore loaded into a car before it was weighed. Several switchings were necessary before the car could be run onto the "automatic" scales, and if the car was then found

railroad tracks with a 16-foot clearance vertically. Each of the rear posts rests upon a four-wheel truck, all four wheels of which are driven. Each front post rests upon a six-wheel truck, only four of its wheels being driven.

On the top of the main frame is the machinery house. Pivoted at the top of the main frame on the water side is a heavy swinging apron which can be raised or lowered. This apron is provided with tracks which line up

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with stationary tracks on the main frame for the travel of the trolley in and out, when the apron is lowered to its horizontal position. Projecting above the main frame is the mast and brace which supports the sheaves and latch for operating the apron and also the suspension rods when the apron is down. Traveling on the overhead tracks is an electrically driven man trolley which handles the 5-ton bucket. Directly underneath the path of this bucket and suspended by heavy rods from the frame work above is the weighing hopper into which the bucket dumps its load and returns to the hold of the boat. This hopper is of 200 tons capacity and has wide flaring sides

quired) he opens the gate slightly again to discharge a small amount. His control of the amount of discharge from the hopper is quite delicate. Small quantities can be loaded as easily as large amounts and with ordinary care he can load within 50 pounds, although the scale beam is graduated to 20 pounds. This cycle of weighing is gone through for each succeeding car, saving a great deal of time and permitting the loading of cars up to the very limit of their excess capacity. A car record is kept by the weighman for each car loaded, this record showing the weight but not the kind of ore loaded, the latter feature being covered in the

hung from four cast steel double flange track wheels which are driven through gearing by one 100-horsepower motor at a speed of 800 to 1,000 feet per minute. The bucket hoisting mechanism is driven by two 150-horsepower motors designed to hoist the loaded bucket at a speed of 300 feet per minute. The bucket as previously mentioned has a capacity of 5 gross tons, a spread of 14 feet and width of 5 feet. It weighs approximately 11,000 pounds.

In the machinery house at the top of the main frame, is located the mechanism for moving the machine along the tracks and also the mechanism for raising and lowering the

man then balances its weight on one of the two beams before him in the house—recording this weight. Then he sets the rider on the second beam to read such an amount (say 50 tons) as he wishes to discharge into the car and by means of the controller at the side of the beam box starts the motors for opening the gates. When the second beam is almost balanced he shuts off the current and closes the gates. In case he has not quite enough ore on the car (say he lacks 200 pounds of the 50 tons re-

operating mechanism on the trolley is mounted on a turntable, permitting the turning of the bucket through an arc of 360 degrees in order to cover as much space as possible in the hold of the boat, and to allow the bucket to be turned across the hatch after it has been lowered down through it lengthwise. Separate hoisting and trolleying motors are provided so that both operations can take place at the same time in entering or leaving a hatch—thus saving considerable time in a day's run. The entire trolley is

cable which runs over sheaves to the apron and as the apron is lowered the pivoted bumper is automatically raised free of the track and the trolley. By a similar cam movement a cast iron cable guard is thrown down automatically at the hinge so as to prevent unnecessary wear on the trolley cables when the boom is being hoisted. Two platforms are provided at the rear of the machine with block and tackle for handling the trolley machinery in case repairs are necessary. These platforms are arranged

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to swing back out of the way when not in use.

The capacity of each of these machines running normally is over 200 tons per hour, but the capacity is easily run up to 300 tons per hour during the first part of a cargo. This plant will unload fully 90 per cent of the modern ore boat without the use of men in the hold When cleaning up a cargo four men shoveling are used to each machine. The entire construction of these unloaders is fireproof and liberal and substantial stairways, ladders and walks are supplied so as to make access to all vital parts safe and convenient. Current is supplied to the entire plant from two conduit rails running parallel with the rear tracks and on either side of them. These conduit rails are protected by continuous steel plate guards which cover them everywhere except where the contact shoes have to pass. Rail clamps are provided—one at each truck as usual. The cars are handled to and from the machines for loading by means of a continuous cable system which is operated under particularly difficult conditions.

SIR CHRISTOPHER FURNESS ON SHIPPING'S DEPRESSION.

At the seventeenth annual meeting of Furness, Withy & Co., at West Hartlepool, July 25, Sir Christopher Furness, the chairman, dealt at length with the cause of the current shipping depression. In part he said:

"We meet today in somewhat singular circumstances. The profits for the year are £341,210, being £8,700 more than in the previous year, which of itself was a record for the company. That is a result upon which we may congratulate ourselves, especially in view of the fact that many companies report large reductions in their earnings; yet I am bound to tell you that in my judgment the general commercial outlook is more unsatisfactory than it has been at any time since the formation of the company. I may even go so far as to say that throughout my business career I do not remember the time when the immediate prospects of profitable business in this country were so unpromising. At our annual meeting two years ago I uttered a warning note as to the consequences which invariably follow overproduction in building ships, and these consequences have been confirmed and emphasized in a degree rendered quite exceptional by the fact that the financial circumstances of the world have brought about almost a total cessation in enterprises requiring new boats, and the freight market continues in a wretched state. I am not of a pessimistic nature, but the fact is that trade generally is passing through a much needed process of pruning from which we may expect it, in the ordinary course of things, to ultimately emerge in a healthy and sound condition.

"In the meantime we can only cultivate patience, tempering it with optimism, and gathering our forces in readiness for renewed effort when that time arrives. Your company is fortunate in that it has always been the policy of the board to husband its strength. For the first seven years the dividend was limited to 5 per cent; since then we have paid not less than 10 per cent, and some years much more. Over a period of eight years our dividend has averaged 12 per cent, and during the last 10 years it has averaged 10½ per cent per annum. For the past year we have reverted to the original amount of the dividend, 5 per cent. It is true that we are in a position to declare a bonus also, if that were deemed to be a wise course to pursue, out of the available balance of £102,315 6s 4d, which we carry forward. I am sure that I have only to explain a good business reason for the non-declaration of a bonus to secure for our policy the entire approval of the shareholders. The reason is wholly to be found in the outlook for the current year, with all its possibilities. The board would do not only an unjustifiable thing, but also an unwise thing, in the face of existing circumstances, were they to make any recommendations as to a bonus.

"A most unusual and regrettable feature of the year's operations is the serious loss incurred at our ship yard of no less a sum than £17,266, without charge for any interest on capital employed in the department. This loss is attributable in large measure to the extreme difficulty of controlling costs of production, due to the serious unrest of labor, as manifested chiefly in the continuous succession of sectional strikes. The friction which occurs, now here, now there, just now in the ship building and engineering yards of the country, has become a chronic friction of a most deplorable character, resulting in irritating and costly uncertainty, waste of time, waste of power, waste of labor, till a point has been reached when we are impelled to ask, can England retain its hold on this great ship building and engineering industry with the continuance of such disorganization and confusion? We are, as it were, in the whirlpool of a grave national and international problem, and it is for those occupying responsible positions to make the best of a very difficult, delicate and trying situation. I am not declaring that it is an unsolvable situation. Given time for reflection, for free play of our racial characteristics for fair play of Englishmen, things may come all right again, and our supremacy in ship building be maintained, but in the meantime we, as employers, have to recognize and deal with a great fact, the friction existing between capital and labor. To one like myself, who has over a fairly long life been engaged in trade and commerce, there appears to be a growing tendency of a most dangerous kind to discourage individual enterprise by hampering it with difficulties. Even zeal for legislative enactments, desirable as many of them are, is apt to become a tyranny in the path of those who devote their lives to the promotion of undertakings for the employment of labor of an ever increasing population.

"Legislation is good and proper when you come to deal with sweated industries, but it surely cannot be suggested for a moment that any of the trades concerned in the ship building, engineering and allied industries come into such a category. Yet abuse of legislative regulations is not the only or worst feature of this tendency. The ways of capital in regard to labor are not alone subject to limits imposed by law, they have become subject also to the active interference of irresponsible and impracticable theorists in alleged interests of workers. It has been suggested by a distinguished man that we are only at the beginning of interventions, directions, and the like, but what if the fact be rather that what we are at is the beginning of the end of our vast and world-envied system of national industry, built as that has been built on bedrock foundations of liberty, of individual initiative, and individual management? If capital, or rather, as I prefer to say, enterprise, is to be blocked first at this turn and then at that, and every detail of procedure of the directors or managers handled and examined and objected to, then progress of industry of this character becomes impossible. There must in future be much more of co-operation than of criticism if production is to proceed on a profitable basis for both parties.

"It will be height of unwisdom if

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we fail to take note of the fact that we are face to face with possible danger of a divergence in our national ways of the gravest character. Until recent years it was regarded as our greatest pride and our greatest safeguard, too, that the industrial and commercial eminence of our country had been largely built up by individual enterprise, by the initiative, industry and persistency of men possessing in generous measure qualities of imagination, foresight and administration and ability to employ and direct capital. In these times such men are in some quarters made not merely the subjects of derision and contumely, but treated almost, if not actually, as people for whom the world has no longer any use, and as a consequence many capable and honest artisans and laborers are confused and perturbed in their minds, and a considerable section of small investors whose savings alone make such industrial enterprises as our own possible, are rendered anxious, because of that which is already invested, and fearful of placing more in the same or similar quarters. If capital is to be had, it must be encouraged, and the only way to encourage it is to reward it.

"The artisan of today is reaping the harvest sown by the enterprise of those who have gone before him, oblivious of the fact that should he devour that harvest in its entirety he will also consume the seed upon which our future national prosperity depends. Whatever wealth may be amassed by employers, it ought to be remembered that such men seldom squander their wealth; few, indeed, derive any personal pleasure from it. Their zest in life is maintained by reusing the capital they have gathered, putting it out against another harvest, and in that way enabling industry in many and varied forms to find profitable employment. The newer theories of ideal social order so assiduously circulated in our midst must ever lack the machinery and direction necessary to their successful consummation, and in that sense are harmless. These are as the mirage of the desert, breeding hopelessness and despair in those who follow after them. That is where danger lies; that is why it behooves us while there is yet time to counteract the evil, lest by indifference we drift along to a state of crisis and chaos that will shake the commonweal to its foundations."

A LINER'S SUPPLIES.

The *New York Journal of Commerce* recently published the following interesting article regarding the provisioning of the many liners which depart from that port, and the part which this country plays in furnishing such supplies.

Taking one thing with another, shipping authorities in New York say it is well within the bounds of a reasonable estimate to put the expenditure of the New York shipping lines in New York itself at $40,000,000 annually. Under this general sum fall the main individual amounts spent for provisions, labor and coal. Other incidental expenditures from which the port and city industries benefit by reflex action necessarily largely swell the total. The provision bill, it is generally agreed, accounts for a sum of $20,000,000 at least.

Vast as is the main interest of the shipping industry directly concerned with the development of New York as one of the world's principal ports, the subsidiary interests connected with the transportation, feeding and comfort of the travelers passing in and out of the city are even of greater relative magnitude. No other seaport city in the world, in fact, can pretend to vie with New York in this respect. As the "stepping off" place of the North Atlantic coast for voyagers arriving at or leaving America, New York is easily the first port of importance in the world. It is inconceivable that it can ever be ousted from the pride of place as the chief gateway of sea passenger traffic. While the shipping companies which find in New York harbor a terminal are in a sense dependent upon New York with its natural advantages for their passengers, the benefit which New York in turn receives from their purchase of supplies is apt to escape so much attention.

In recent years with the rapid growth of tonnage and speed of the Atlantic liners the quantities of coal, provisions and other supplies purchased in New York have increased proportionately. The local markets find no small proportion of their supplies steadily going to the store rooms, larder, pantries, kitchens and refrigerator rooms on board the great ships berthed week in, week out, in the docks of the North river. The best fruit, the best vegetables, beef, milk and perishable provisions sufficient to last for the voyage to the other side must be stocked by the ship's stewards. The standard of catering for the ocean passenger has risen with the scale of luxury prevailing in the New York hotels. There is scarcely any difference to be found nowadays between the menu of a first class hotel of New York and that of the chief ocean liners of any of the great steamship companies. And New York as a food emporium has hardly an equal for the variety and quality of its provisions.

The steamship fitted luxuriantly to be a floating hotel, with elevators, residential suites, dining saloons in which private dinners are served at the desire of the passenger at any time, carries the traveler across from one hotel on terra firma to another with hardly a perceptible break, since the horrors of seasickness have become a diminishing quantity.

What is actually spent by the steamship companies frequenting New York port on supplies and provisions taken aboard in dock here it is impossible to calculate with precision. Each line has its own system of provisioning and in estimating the cost of supplies there is no way of reducing to a common standard the quantities and values. In some cases the supplies are taken for the round trip. In others only for the voyage across or half trip. Usually the bunkers are filled with coal here for the voyage to England and replenished there for the return voyage. But ships sailing to the European ports and to the Mediterranean, where there is no native coal to be obtained cheaply, frequently find it best to carry American coal for the round voyage. There are other items of the ships' bills, such as the laundry, which make a big factor in the employment of local concerns.

That the local industries of New York are intimately bound up with the growth and prosperity of the shipping companies engaged in ocean transportation needs no insistence. When the bulk of the provisions and supplies they obtain through the New York market is realized it becomes apparent that any general raising of the overland freight rates must affect them proportionately, as they touch the local markets and shippers.

Last year the steam vessels which cleared from New York port, according to the customs figures, numbered 3,119 with an aggregate tonnage of 10,162,340. Of these the countries for which they sailed were United Kingdom, 487; Germany, 224; Italy, 198; France, 172; Netherlands, 109; Belgium, 99; and Denmark, 42. This total of vessels, of course, includes the reappearance of the same vessels on the regular routes of the various steamship companies. The companies whose vessels dock at New York number more than 60, with periodical sailings to all parts of the world.

According to the official figures of the passenger traffic outward from New York, there were made in 1907 (last year) 1,020 trips. In all, 658,043 passengers were booked as sailing from this port. Of these 86,862 were first class, 82,773 second class and 488,408 third class.

From estimates supplied to *The Journal of Commerce and Commercial Bulletin* at the offices of several of the prin-

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cipal steamship companies in New York an idea may be gained of the great sums spent on provisioning the ships in New York.

The International Mercantile Marine Co., which is responsible for the American line, the Atlantic Transport, the Red Star and White Star lines, spends between $4,500,000 and $5,000,000 yearly on the provisions and supplies of its 29 ships.

The Hamburg-American line apportions its gross annual expenditures in New York in the following approximate amounts:

For provisions about	$1,500,000
For labor about	1,000,000
For coal about	1,200,000
Total	$3,700,000

Other expenses, such as salaries, repairs, rents, etc., more than double the above amount as the total expenditure of the company. It has 20 ships regularly using the New York docks. Last year it had 109 sailings to North Atlantic ports and 154 to the West Indies and South America on its Atlas service.

Figures recently published give the cost of food supplies for the steamships of the North German Lloyd as more than $4,000,000. During the year about $7,000,000 worth of coal was expended. The 661,258 passengers carried by the company's steamers consumed some 7,000,000 pounds of flour, and 1,200,000 pounds of sugar. Twenty million pounds of potatoes were used and no less than 24,956,893 pounds of ice required. Six carloads of grapes were consumed. On fresh vegetables the sum of $108,843 was spent.

From New York last year there were 155 clearances of this company's vessels, and perishable provisions would in any case be taken from New York. The bulk of the coal is purchased in New York and there was actually paid out during the year, the end of which was exceptionally dull, a sum of $721,000 for stevedoring and clerk hire. This amount, of course, does not cover the charges for towage, tugs, taxes and other salaries.

The Cunard with a fleet of 12 ships on its regular schedules spends about $2,400,000 on provisions, wines and liquors. The yearly laundry bill is in the neighborhood of $104,000. With regard to the coal bill the liners coal each trip at the starting point, but for the Mediterranean service sufficient is taken for the round trip. New York thus gets the balance, and is benefited to that extent. Half the above mentioned sum may be taken as representing New York's portion, to which the expenditure for labor, taxes and general upkeep have to be added.

Among the smaller companies the Holland-America line alone spent $1,300,000 on the food supplies of its steamers. The meat, exclusive of poultry, fish and game, amounted to 4,000,000 pounds, a quantity which would require about two miles of refrigerator cars. Of ice cream aboard its steamers 200,000 portions were consumed. The fruit made a total of 1,500,000 pounds and 1,000,000 cigars and 500,000 packages of cigarettes were smoked.

Inquiries of the store superintendents of the Italian, Scandinavian and other lines elicited the same response. There has been a general leveling up of the standard of food and whatever be the national taste for particular kinds of food and menu, the fruit, vegetables and meat put on board from New York show a general similarity of demand.

Nor is the French line behind in any particular as regards its provisions. The strictest scrutiny is kept over the supplies of fruit, nothing but the best being accepted for the passengers' table.

By a coincidence the star vessels of two great lines, the White Star's Adriatic and the Cunard's Mauretania, left New York on the same day last week. Both have now been running for more than a year on the trans-Atlantic route between New York and Liverpool or Southampton. The chief stewards of these giant liners gave *The Journal of Commerce* many details of the supplies being then taken on board for the current trip to England. The Adriatic had completed her seventeenth voyage and has proved herself one of the favorite vessels in which Americans prefer making a leisurely passage "across the pond" to England. She has never carried fewer than 200 passengers in her first saloon. It is customary to store aboard on the average for each round trip at least 25,000 pounds of beef. Beef of the best quality is always obtained in the New York market. The mutton or lamb supply to the extent of 20,000 pounds for the round trip is supplied by the English market. Loins of pork to the extent of 2,000 pounds are requisitioned. For cured hams and bacon the brands from the other side are preferred. For the Adriatic's floating population must be requisitioned for each trip, moreover, 200 barrels of flour, 30,000 eggs, purchased about half and half at New York and Liverpool, respectively, 800 pounds of fresh butter and 2,000 pounds of salt. Fresh vegetables are obtained from both sides in equal proportions, according to the season's flow of passengers at different times of the year. In the steward's opinion, New York cannot be beaten as a fruit market, and all the year round the ship is supplied from the southern states, the West Indies or California. About the only exception are English hothouse grapes, and in limited quantities in their brief season English strawberries, gooseberries and picked apples. Grape fruit is taken in increasing quantities, as the taste for the fruit has spread and 50 boxes are now taken on a trip. Fifty cases of melons were placed on board, 30 bunches of bananas and at least 100 boxes of oranges would be consumed on the voyage. The regular stock of tea and coffee is supplied from Liverpool, but the canned goods are a staple American product purchased in New York, while potatoes figure to the extent of 25 to 30 tons in the diet of the ship's passengers and crew. The turtle soup for the voyage is made from 400 pounds of turtle, two monster turtles being placed in the ship's tanks.

The Mauretania's provision list consists of some couple of hundred items. Varying quantities of these must be ordered for each voyage on the basis of a 16-day round trip. As the comfort of the ocean voyage has been increased by the steadiness of the bigger ships and the elimination of racing screws, vibration and other drawbacks of ocean travel, perhaps the average consumption per capita has risen, but this factor does not count for so much when it is considered that it has always been necessary to provide supplies of food on the most liberal scale. The chief difference from the steward's point of view is that owing to the fuller dining tables there is not so much waste food nor is there so great a chance on the average weather voyage of large remainder stores. The Mauretania's larder and pantry for the present trip required to be repleted with 32,000 pounds of beef, and about 25,000 of mutton; eggs were 50,000 in number; flour was taken in 250 barrels, 35 tons of potatoes, 1,500 quarts of condensed milk and 500 gallons of fresh milk from New York, together with 240 quarts of cream. Ice is consumed at the rate of 25 tons a voyage. The oatmeal necessary is 1,800 pounds, the cheese eaten mounts up to 32,280 pounds, and a sum of $650 is paid for vegetables. The tea chests consist of 250 pounds of Ceylon, 20 pounds of China, 100 pounds black, and 600 pounds of ship's tea, with coffee in proportion, the American passenger taking the larger quantity.

When stock has been taken of the dependence of the great Atlantic lines upon the food resources of America and the distributing markets of New York, the total sum for food paid by the ships lying at New York docks is not by any means exhausted. The South American, Oriental, West Indian and Gulf lines must all be added. The Barber, Norton, Wilson and many other lines, whose ships are chartered here, together with the tramp steamers for whose crews food and coal must be provided, should be included in the aggregate. It is considered by shipping experts but reasonable to estimate that the annual sum of $20,000,000 is spent by the shipping companies of New York in the New York market for food supplies alone.

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THE MARINE GAS ENGINE.

London *Engineering* in a recent issue treats the above subject at considerable length editorially and with a thorough knowledge both technical and practical, and from which we quote liberally.

"The advantages to be obtained from an installation of large size for marine propulsion are a saving of one-third of the space occupied by machinery, and a reduction of the total weight of machinery of possibly one-fourth. While the engine itself would have to be much heavier than a steam engine of the same power, the necessary gas producers would be much lighter than the steam boilers. As the gas engine and producer have a thermal efficiency about double that of the combined thermal efficiency of the steam engine and boiler, it should be possible to get a horsepower at the propeller for 1 lb. of coal per hour, and also to obtain it from a cheaper grade of coal than can be used to advantage in a boiler. The last-named advantage will appeal strongly to owners in the mercantile marine, as it will enable the fuel cost of transport per ton-mile to be considerably reduced. Gas producers, when once charged, will go on making gas for several hours without further attention. In Beardmore's tests on board ship the producer, once charged, runs for 10 hours without attention. The same large force of stokers needed for a steam installation of any size will not therefore be required. Where there are many producers they would be charged in succession, and not more than two or three in any one watch. There would be considerably less than one-quarter the amount of ashes to handle in a given time, and there should be no clinker at all. There would be no smoke, and, therefore, the large funnels, with their wind resistance, would not be present. The space usually occupied by uptakes would also be saved. This advantage would be of considerable value to naval vessels by enabling them to almost get into range before their presence could be detected. It must be remembered that each and every cylinder in a gas engine is a complete engine in itself, and should one or more break down, the disabled cylinder could be put out of operation, and the propeller turned as long as there was a single cylinder left in working order. It is only necessary to remove the connecting rod, and the rollers that are operated on by the cams, in order to disconnect a cylinder—a much lighter job than would be required in the case of a steam engine, though the weight to be handled might be greater.

The disadvantages of gas propulsion for marine use, though many in number, are not by any means insurmountable.

* * * * *

"It has been considered a disadvantage that most gas engines are fitted with trunk pistons, and that therefore the connecting rod pin is inaccessible, and the piston, when worn, has to be entirely renewed. But when gas engines are built specially for marine use, they will be of such a size that they will have thin water-cooled pistons, be double-acting, and be fitted with the ordinary crossheads and slides used upon steam engines; or if trunk pistons are used, they will be fitted with adjustable shoes to take the wear in the wake of the connecting rod pin.

"It is generally considered to be a difficult matter to make a gas engine reversible, but this is only because it has generally been attempted with the usual revolving cam-gear, and on engines of comparatively small size. On large engines, oscillating instead of revolving cams can be used with advantage, and these can be operated by the well-known Stevenson link motion or by the Joy, Marshal, or other radial reversing valve motion, worked by compressed air when the engines are very large.

"A special compressor, driven by an independent gas engine, will always form part of a marine gas engine installation, because compressed air will be required for starting the main propelling engines, blowing the whistle and syren, working the reversing engine, circulating and other pumps, steering engine, capstan, deck winches, ash hoists, etc., which are now part of the recognized outfit of the modern steamship. Under certain circumstances, all this work might be done by electricity, in which case a separately driven electrical generator would take the place of the air compressor. A disadvantage of the gas engine for marine propulsion is its want of flexibility in the rate of revolution at which it can be driven, but there are several ways in which this can be met, such as cutting off the gas supply to one or more cylinders, building the engine in two or more distinct units which can be readily connected up or disconnected, applying the total power on three or more shafts, so that one may run ahead and two astern, or vice versa, so that a ship of large total power may be run at very slow speed when necessary."

* * * * *

Within the past few days Prof. Fernald, of the Case School of Applied Science, and who had charge of

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the producer and gas engine tests at the U. S. Geological Survey's Fuel Testing Plant at St. Louis, speaking on the same subject, said:

"One of the big steamship companies of the great lakes is about to take the initiative in this movement. Plans have been made for a freighter that will use a 2,000 horsepower gas engine. This company is making the experiment to test the economy of the gas engine over the steam engine."

Prof. Fernald is probably better equipped to speak of the economic value of the producer and gas engine than any engineer in the United States, as a result of his experience with the Survey's tests, which were of an extent never before attempted.

In the issue of Oct. 3, 1907, the REVIEW presented a paper which treated at length of the application of the suction producer and gas engine to marine work, with portions of general plans, etc., as made for an actual installation in a 10,000-ton lake ship. The paper considered very fully the methods of providing for and handling auxiliaries, comparative weights, strains, and heat economies, and is the most complete presentment of the subject so far published and was the result of many months' laborious investigation and effort. These are the plans referred to by Prof. Fernald, and while we are not at liberty to disclose the identity of the company, nor of the author of the paper and plans published now nearly a year ago, we can say that the facts are substantially as stated, and it is entirely probable that it will be but a short time before the first installation of the system will be taken in hand. It is improbable however that the first installation will exceed 900 horsepower.

The plans have been under consideration and in preparation for nearly two years and almost all the problems involved have been worked out, but progress in such a matter is necessarily slow, and every conceivable phase must be considered and studied before coming to a decision. Meantime experiments have been quietly but thoroughly made on large size suction producers, of designs adapted to ship work, and the difficulties in that direction, which long seemed insurmountable, have been satisfactorily solved. It has been proved possible to get rich, clean gas, perfectly free from tar and free carbon, and suitable for engine work, for long periods, from bituminous coal such as used for fuel on lake ships. It will be found, upon turning to the paper, that practically all of the problems noted by *Engineering* had already had consideration and the solution found and stated.

It would be most gratifying if the first practical application of gas power to the sea-going ship should be worked out on the great lakes where so much has been done in the development and cheapening of transportation, and the manager who takes the initiative will have built for himself an enduring monument.

LAKE FREIGHT SITUATION.

There is no appreciable change in the freight situation. Neither coal nor ore is moving freely and there are more vessels on the market than can be placed. It would not be surprising if additional tonnage went into ordinary. Some of the leading shippers are out of the market altogether and others have about all that they can do to take care of contract ships. The reduction in the coal movement is likely to be sensibly felt in the northwest during the winter. The amount that is moving forward into the interior is not great, so that upper lake docks are crowded. The trouble is that consumers are reluctant to place orders while the state of industry is so uncertain.

PIG IRON SITUATION.

Pig iron is dull in nearly all sections except the east where there is a fair demand. In the Pittsburg district there is a tendency toward weakness. Several leading interests in the south have advanced quotations to $13 Birmingham and are practically out of the market in which $12.50 can still be done. Demand for malleable iron has increased in New York and New England. Steel making iron is in light demand in Pittsburg and quotations are lower. Fair volume of business during the past six months has resulted in the seller being placed in an improved position. Coke production has increased in the Connellsville district until the principal producer is now operating 60 per cent of its oven capacity. One of the most significant signs of the improved situation from the iron and steel makers' viewpoint is the receipt of orders for lake vessels and freight cars which will require about 25,000 tons of shapes and plates. Specifications on nearly all finished products are coming in satisfactorily.

NEW DRY DOCKS FOR AMERICAN SHIP.

The Barnett & Record Co., Duluth, has been awarded contract by the American Ship Building Co. to enlarge the present dry dock at its Superior plant. The dock at Superior is now 450 ft. long, but it is the intention to extend it 160 ft., making it 610 ft. long and of sufficient width to accommodate the largest vessels on the lakes. The contract calls for an expenditure of about $150,000.

In conjunction with this the company has decided to make its plant of the Buffalo Dry Dock Co. one of the most complete on the lakes and to this end about $300,000 will be expended upon a new dry dock to be 630 ft. long, 100 ft. wide on top and 75 ft. wide at the bottom. Bids for this work will be solicited in the near future, the plans for the new dry dock having practically been completed by A. V. Powell, engineer, of Chicago. The new dock will be built on the site of old docks Nos. 2 and 3. Docks Nos. 1 and 4 will not be changed. When the new dry dock is finished the American Ship Building Co. will have three modern dry docks at Buffalo.

DEATH OF CAPT. DONNELLY.

Capt. Thomas Donnelly, president of the Donnelly Wrecking Co., and the leading underwriter of Canada, died at his home in Kingston, Ont., on Monday of this week, at the age of 52 years. Mr. Donnelly was well known on the great lakes, having been for a number of years inspector of hulls at Kingston, examiner of masters and mates, and inspector of Lloyds and Bureau Veritas.

As head of the Donnelly Wrecking Co., he had charge of the work of releasing the steamers Hurlbut W. Smith and Wm. Nottingham, of the United States Transportation Co.'s fleet which went ashore near Buffalo in the winter of 1906.

The French Line steamer Savoie arrived at Havre recently with a broken propeller shaft and minus one of her propellers. As a result of her mishap she was two days behind her schedule.

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THE MODERN DEVELOPMENTS OF THE MARINER'S COMPASS.*

BY J. C. DOBBIE, ESQ., ASSOCIATE.

None of the many practical problems connected with magnetism are of greater interest or importance than those which are concerned with its application to the mariner's compass. The mariner's compass has been the subject of more speculative inventions than perhaps any other instrument, and it has occupied the minds of many inventors besides those directly connected with its construction. The problem of securing an efficient steady compass is one which is always more or less with us.

By a "steady" compass is meant one in which the card will not oscillate in a seaway, and so make steering difficult or impossible. The employment of iron, and especially steel, in the construction of modern ships, and the difficulties due to their increased speed, have materially complicated this problem.

The invention of the compass is ascribed to Flavio de Gioia, or Flavio of Amalphi, about 1302, but it is now well established that his improvement was the poising of the magnetic needle of the compass on a pivot. Gilbert, in *De Magnete,* says it was brought from China to Europe about 1260 by Marcus Paulus, Venetian, commonly known as Marco Polo. This is probable, as early Europeans used the same device as the Chinese, viz., a magnet floating in a basin of water by means of a straw, or of a piece of cork or wood. The Chinese, however, used 24 points, and Flavio 8 points, as against the 32 points now employed.

It is a well established fact that the directive force of a compass is necessarily lowered through the influence of the iron or steel of which ships are constructed. This influence is minimized by placing the compass in what is known as a "favorable" position in the ship.

The adjustment of the compass, i. e., the compensation for the ship's disturbing force, resulting in the more or less complete restoration of the earth's magnetic force, has reached something like perfection on the lines laid down by the astronomer royal of his day, Sir George Airy—known as the father of the system of compass adjustment—and by Archibald Smith, of Jordanhill, Glasgow. Their views were embodied in practical form by John Gray, of Liverpool, and in later years by Sir Wm. Thomson (Lord Kelvin) and others. The use of magnets for compensating the compass was, however, first suggested by Barlow.

The transitory deviation, due to what is styled sub-permanent* magnetism—a disturbance due to temporary magnetization of the ship's hull, which develops after a change of course—was in the main got over, originally by the employment of the mast compass, and latterly by placing the standard compass on the top of the wheelhouse, or other structure, as far removed as possible from the magnetic influence of the ship's hull.

While these factors were successfully dealt with, and greater steadiness of the compass secured by thus increasing its directive force, the disturbance due to the vibration or rolling of the ship remained to be dealt with, and in recent years this has been practically the only serious problem left to solve, at least in merchant ships. The method devised to deal with this problem has been the adoption of some system of suspending the compass bowl in the binnacle, or the card in the compass, but the systems hitherto employed have not been entirely satisfactory, especially in modern fast ships, and so some additional method became necessary.

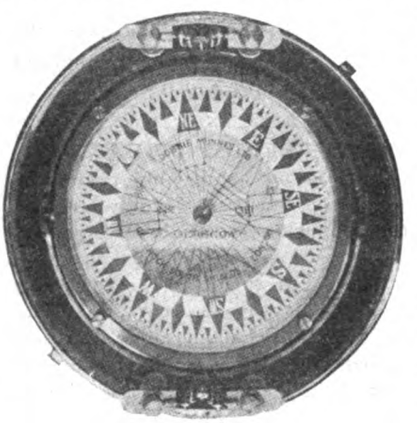

FIG. 1.
THE THOMSON COMPASS CARD.

As the adjustment of the compass has so important a bearing on the whole subject, the steps taken to put Sir George Airy's theories into practical shape may now be described. Gray, in the sixties, was the first to employ a binnacle with the semi-circular and heeling magnets all enclosed in the binnacle casing, together with quadrantal deviation correctors composed of boxes filled with soft iron chain, or pieces of cast iron shaped like clock weights, as recommended by the Liverpool compass committee; to the secretary of which, W. Rundell, we owe so much. It was not until Lord Kelvin introduced his famous compass that correctors for quadrantal deviation took the improved form of spheres, and that the Flinders bar was, in its present form, attached to the binnacle casing. The Flinders bar is the invention of the great explorer Captain Flinders, and consists of a soft iron bar placed, in most cases, in front of the binnacle, to compensate for the component part of the semi-circular deviation caused by the vertical soft iron of the ship—constant *c* in the Admiralty Compass Manuals. The ship's vertical soft iron must necessarily change its magnetic force with change of geographical position, and the Flinders bar is placed vertically in such a position, relatively to the compass, as to counter-balance the changing value of this vertical soft iron. In its original form the Flinders bar was separate from the binnacle casing, and, although inconvenient, it is for some reasons the better method; but I shall refer to this later. Thus we have Thomson's system of compass and binnacle, the first in which were collected together all the elements necessary for complete compensation. His compass, as is well known, is fitted with a light card with short needles, to allow of the more perfect adjustment for quadrantal deviation (Fig. 1). In his own language, his compass and binnacle were designed to put Sir George Airy's theories into the best practical shape. It is worthy of note, however, that short needles were used by W. Rundell for the steamer Scotia's compass as far back as 1865.* With the growing vibration of steamers the problem of producing a "steady" compass was, however, always cropping up.

As already mentioned, the Chinese apparently used a crude form of liquid compass. In fact, liquid compasses in some shape or form have always been in use, and some 30 or 40 years since, the Ritchie (of Boston) spirit compass, an American invention, held the field. Gray, of Liverpool, and other inventors, while employing a dry compass—i. e., one in which the vibrations of the card are damped down only by the air in the bowl, floated one bowl inside of another in liquid, and this device was

*Read at Institution of Naval Architects.

*Known variously as "Retentive Magnetism," "Gaussin error," or "Hysteresis," but none of those terms is quite descriptive of this error.

*With the advent of iron ships the single needle was discarded, and magnets in pairs 60 degrees apart were attached to the compass card.

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more or less successful.† But by far the most successful suspension for a dry compass was the Thomson grummet (Fig. 2). This suspension is an elliptical ring composed of one length

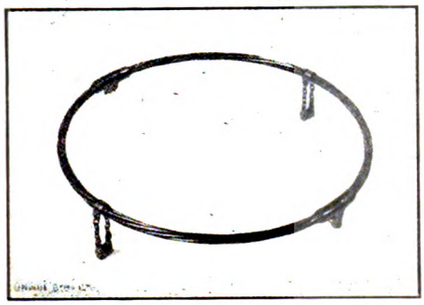

FIG. 2.
THE THOMSON GRUMMET RING.

of brass or copper wire twisted several times round a core wire in such a manner as to give considerable elasticity. From this ring are hung athwartships, exactly opposite one another, chains with stirrups in which the trunnions or knife-edged journals of the gimbal ring rest. On the under side of the ring sockets are fixed, exactly fore and aft opposite one another, which rest on small balls fixed to the binnacle rim. Figs. 3 and 4 show other systems of spring suspensions, but it is a matter of doubt whether those are improvements on the grummet ring suspension. In recent years, however, even this ingenious arrangement has failed to meet the increasingly onerous conditions, and apparently the suspension of the card in liquid is the system to which we must look for the best practical results.

Whether the failure of the dry compass to cope with the new conditions arises from the fact that the construction of the Thomson card gives it something of a fly wheel action, in turn partly braked by the paper rim, or from the fact that spring suspensions of any kind are not constant, it is certain that when the card is suspended in a suitable liquid, which will not change its condition, the suspension is a constant one. In the liquid compass the card is not actually floated by the liquid, but is sufficiently heavy to poise on the central pivot.

It is difficult to ascertain the exact effect of the new conditions which militate against the steadiness of the dry compass; but, so far as fast steamers are concerned, the opinion is that speed, combined with vibration, causes the cap which supports the card to lift slightly from the pivot and fall back again. This would quickly set up oscillation on the card, and accentuate any fly wheel action.

I have known of compasses suspended by spring suspensions being actually thrown out of the gimbals. This was possibly due to the movements of the ship and the movements of the spring suspension coinciding.

An extraordinary incident came under my notice not long ago. In a London steamer, in which the standard compass was placed about 10 ft. from a steam whistle, the card was subject to violent oscillations when this whistle was blown. Another compass and card placed in exactly

FIG. 3.
THE KELVIN SUSPENSION.

the same position showed no oscillation, and the theory put forward to account for this was that there was some relation between the sound vibrations of the whistle and the tremors of the compass bowl in the former case which did not exist in the latter. I am inclined to think, however, that what really happened was that vibrations were set up in

FIG. 4.
THE DOBBIE SUSPENSION.

the glass of the bowl which caused the pipe, projecting downwards from the center of the glass to prevent the card rising, to strike against the cap, and so set the card in motion. I have not had an opportunity of trying this compass bowl with a different glass, but I imagine the disturbance arose from the glass and not from the bowl.

Captain E. W. Creak, C. B., R. N., in his "Elementary Compass Manual," warns us that "the mariner's compass is at the best a delicate instrument. A fiber that can hardly be seen by the naked eye, attached to the edge of the card and touching the side of the bowl, is quite enough to overcome the earth's directive force on the needles, and stop the card, while the ship's head has turned through 10° or more. The earth's magnetic force may then assert itself, and the card go off with a swing."

Considering all the circumstances enumerated, some of us have come to despair of ever getting a dry compass to work satisfactorily under every condition, and have been driven to experiment, more particularly, with the liquid form of compass.

The objections to the older forms of liquid compass were the interference with perfect adjustment due to the length of the magnets on the card, necessary to give it sufficient directive force; and the motion set up on the card by the annulus of liquid disturbed by the motions of the bowl, when a ship turned quickly in azimuth. In the new form of compass now to be described, these objections are overcome.

Previous to the end of last century, Captain Creak constructed a compass bowl, slightly hollowed out opposite the periphery of the card, leaving a greater distance than usual between the wall of the bowl and the periphery of the card, and undoubtedly this was a step in the right direction.

In 1901 the writer took out his first patent for a form of compass, the main feature of which is that the card is of such small diameter as compared with the bowl, that it is absolutely withdrawn from the annulus of liquid disturbed by the motions of the bowl. After being subjected to the most severe tests, this class of compass has been adopted by the British admiralty for service use, and is to be fitted for the standard and steering compasses, in future, in the navy.

The objections to this compass are the small size of the card, and the error of parallax, arising from the

FIG. 5.
THE DOBBIE COMPASS.

†The first suspension of compasses by means of gimbals to allow of the compass always taking up a horizontal position, known as "Cardan's Suspension," is of such importance that it is in use in all compasses. The suspensions mentioned in this paper are for another purpose, viz., intercepting the disturbance of the compass card caused by vibration, etc.

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edge of the card being so far removed from the usual lubber line on the wall of the bowl. I provide for this by introducing a special lubber line, or pointer, in close proximity to the card, to represent the ship's head. In a later development I use a ring form of card, as shown in the illustration, marked with degrees and cardinal points only (Fig. 5). The degree divisions can be made so prominent that a steersman can readily see them, and these show up better in the absence of the darkening effect of the points and half-points. At first a magnifier was employed to read the card, but this was inconvenient, especially when using the azimuth instrument, and is rendered unnecessary by employing this style of card.

It is certainly an innovation to use a card marked with degrees only; but, as steering to degrees is now universally in use, the elimination of quarter-points and half-points is of little consequence and not injurious. As the degrees in all cards are nearest the periphery and quite close to the lubber line, this new arrangement should make for closer and more accurate steering than formerly.

Perhaps the best evidence of the superiority of this class of compass is afforded by the result of experiments made by Dugald Clerk, the writer, and others. It was found, with a compass constructed with a card of sufficiently small diameter as compared with that of the bowl, that the card was not deflected appreciably, even if the compass were turned through the whole 360° in a few seconds. As the fastest steamers afloat take about 50 seconds to complete a round turn, it is obvious that any disturbance from the turning movement of the ship is entirely eliminated.

A further advantage is, as with all liquid compasses, that magnets of great directive force are employed. With the Thomson and similar compasses where light cards are used, the magnets or needles are necessarily of small directive force, as Captain Creak points out in the paragraph from the "Elementary Compass Manual" already quoted. But his warnings do not apply to this compass in which powerful needles are used, and the periphery of the card is well withdrawn from the wall of the bowl. This is a comparatively robust instrument.

Returning to the subject of adjustment of the compass: The main reason for the adoption of short needles is that, if they are over a certain length, they magnetize by induction, the quadrantal correctors. I do not think, however, it is so well known that the Flinders bar sometimes gets magnetized in a similar manner by the semi-circular correcting magnets. In my own experience I came across

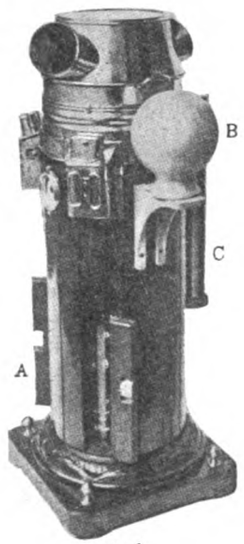

FIG 6.

a case in which there was some obscure disturbance of a compass. It occurred to me to increase the distance between the lower end of the Flinders bar and the magnets, when I found that the disturbance disappeared. To obviate this danger I should like to see the Flinders bar kept separate from the binnacle casing in accordance with the original practice of Captain Flinders illustrated in Fig. 6, where A shows one of the receptacles for magnets, B a quadrantal corrector, and C the casing for the Flinders bar.

It is a true saying that there is nothing new under the sun, and today we have the return of the liquid compass—not in the crude form employed by the Chinese, but constructed to suit modern conditions.

Naval architects will readily appreciate the reasons for the success of this class of liquid compass, as they have to deal with a similar problem in connection with the trial trip of steamers, which must take place in sufficiently deep water, to avoid the drag, due to friction or some similar cause, which lowers the speed. In the same way this compass is constructed so as to have deep water all round the card, and also above and below it, in order to eliminate "the drag."

I have designed an azimuth circle, as shown in the illustration (Fig. 7), which permits of bearings being taken at high speeds—which is not always possible with the form of azimuth most commonly in use—and also without removing the binnacle top, an im-

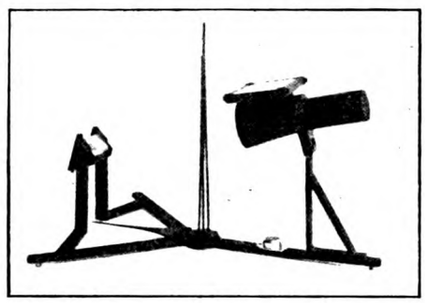

FIG. 7.
AZIMUTH INSTRUMENT.

portant factor in bad weather. Captain Creak has a similar azimuth circle for taking instantaneous bearings, designed many years ago.

(To be continued.)

HENRICH'S AZIMUTH TABLES.

The MARINE REVIEW has received a consignment of Frank Henrich's Azimuth Tables for the Great Lakes. Since this work was issued it has met with a most favorable reception and is generally regarded as presenting the simplest and most efficient azimuth tables ever issued. The decimal system, which gives results sufficiently accurate for practical purposes, is used, and all data needed for the finding of true bearing are published on the same page. This arrangement permits of interpolation for any given time both as to latitude and declination without turning the page. The book contains numerous auxiliary tables and maps with complete instructions for using them, together with abundant examples for practice. It is considered by competent navigators one of the best mediums for self-instruction ever issued.

Capt. Henrich has received letters of commendation upon this book from H. Coulby, president and general manager of the Pittsburg Steamship Co.; G. A. Tomlinson, Capt. P. H. Uberroth, commanding revenue cutter Tuscarora, and from many vessel masters as well as from the steamboat inspection service.

The Wisconsin Engine Co., Corliss, Wis., announces that in addition to Corliss engines of all types they will hereafter build gas engines as well. Charles E. Sargent will be the engineer of the gas engine department. The company controls Mr. Sargent's patents on internal combustion engines.

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BUSINESS FOR AMERICAN SHIP BUILDING CO.

An important order was placed with the American Ship Building Co. on Tuesday of this week, by the Pittsburg Steamship Co. for the construction of two giant cargo steamers to cost over $900,000. Mr. Harry Coulby, president of the Pittsburg Steamship Co., and Mr. Robert Wallace, president of the ship building company, negotiated the deal.

The new boats, which are to take care of the trade with the recently opened port of Gary, Ind., are to be of the largest class, and will go into commission at the opening of navigation next spring. They are to be of practically the same design as the last eight steamers built for the Pittsburg company, viz.; the Thomas F. Cole, George F. Baker, Henry Phipps, Thomas Lynch, J. Pierpont Morgan, H. H. Rogers, P. A. B. Widener and Norman B. Ream, being designed to be 600 feet long over all, 580 ft. keel, 58 ft. beam and 32 feet deep. Both will be fitted with triple-expansion engines and two Scotch boilers, the latter to be 16 ft. in diameter and 11 feet 9 in. long. The steamers are to have a carrying capacity of 13,000 tons each.

The keels for these vessels are to be laid down in the new berths at the Lorain yard. This plant has been without new work for a number of months but will now be able to employ a full force of men for the entire winter.

The United States Steel Corporation will, of course, furnish the 10,000 tons of steel which will be required in the construction of the steamers for its subsidiary company, and in addition has received a provisional order from the American Ship Building Co. for an additional 10,000 tons of steel to be used in the construction of other tonnage for which Mr. Wallace expects to have orders shortly.

One interesting feature of the deal is that the American Ship Building Co. has purchased the engines and boilers of the wrecked steamer Lafayette from the Pittsburg Steamship Co. and they will be placed in one of the new boats.

If the orders which are now under consideration are placed the work will undoubtedly come to the Cleveland yard of the American Ship Building Co. The Globe plant is undergoing considerable improvement, as a large part of the machinery taken from the dismantled Bay City plant is being installed there.

The American Ship Building Co. also awarded a contract to the American Bridge Co. on Tuesday, for the construction of the new boiler shop to be built at its Lorain yards. This plant is to be one of the largest of its kind on the lakes and work will be begun at once in order that it may be completed in time to execute the necessary work for the new steamers to be built there.

BARGE CANAL GREATER THAN PANAMA.

Col. Thomas W. Symons, who is a member of the state advisory board for the New York state barge canal, while in Buffalo recently on a tour of inspection, gave it as his opinion that the work on that waterway is of greater magnitude than that on the Panama canal.

In answer to a question as to how the canal work is progressing, Col. Symons said:

"In general the work is making good progress, both in carrying on the work under contract and in getting out plans for new work. The work in Tonawanda Creek, I am very sorry to say, is not progressing in a satisfactory manner—the amount of work accomplished not being anywhere near the contract requirements.

"The work on the barge canal is bigger than that on the Panama Canal. There is more excavation and more masonry, and the canal is longer than the Panama. Then there are almost innumerable complications. The canal runs through a thickly populated district where the people and industries go along in established grooves. The canal must not interfere. There are rivers where power is developed, and here the work must be planned not to diminish the effectiveness of the stream or to interfere with the power development.

"About one-third of the work is under contract now—probably more. Plans and specifications have progressed rapidly under the different contracts. The Champlain canal is progressing very rapidly. At Oswego the work is going ahead most favorably, although some question as to the state's rights has delayed operations in that locality. The Erie canal section of the work is going right ahead. In the Mohawk valley, at Rochester, Lockport and Oneida Lake and river the progress is fine, also at Baldwinsville.

"It is interesting to the general public, to whom the exact nature of this big undertaking is not quite clear, to know that less than one-fourth of the new canal course is coincident with the old one. Wherever possible the new course takes advantage of natural waterways on the line between Buffalo and Albany.

"Four years ago the work was begun. The best location for locks and dams, the nature of the rock formation and a hundred other things had to be carefully investigated and plans made accordingly. The work has progressed favorably on the whole. Of course, there have been delays with changes of administration, as it naturally takes new men a little while to learn the intricacies of the situation."

MUCH COAL AT PITTSBURG.

An inventory which has been made of the coal now stored in the Monongahela river at Pittsburg, awaiting high water, shows that the greatest amount of coal ever collected in one place is now on hand.

There are nearly 15,000,000 bushels stored in 663 different coal boats and barges, the largest number of loaded craft ever known. It is valued at about $1,500,000, as it lies, and half the boats are already hitched together ready to go out on the first sign of water. There has been no rise since last April, and rush orders from New Orleans will be filled this coming week by train.

It is computed that the coal now in the harbor would, if loaded, require 28,325 cars, which would make a solid train of 473 miles in length, or one that would reach from Pittsburg to beyond New York if started east, or beyond Chicago if started west.

There are many empty boats lying below Pittsburg, but they cannot be brought into the pools to be loaded because of lack of water.

LLOYDS SUMMARY.

Lloyds Register of British and Foreign Shipping has issued its annual statistical summary of vessels of all nations, of over 100 tons and upwards, totally lost, condemned, etc., during the year 1907.

This circular records that of steam vessels of all nations there were 273 lost during 1907, having an aggregate tonnage of 408,328, of which 11 of 35,004 gross tons were of American registry. Steamers trading on the great lakes are, however, excluded from this schedule.

Of sailing vessels of all nations there were 367, with a tonnage of 213,110, totally lost during the year, of which number 94 were American vessels aggregating 58,289 tons. As in the case of steamers these figures do not include losses on the great lakes.

The report is arranged in the form of tables giving the various causes of losses, such as fire, collision, foundering, etc., under which the number of vessels suffering such casualty is set down opposite the country of its registry. The tables also include the number and tonnage of vessels owned by each of the maritime nations.

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LAKE SHIP YARD METHODS OF STEEL SHIP CONSTRUCTION.

BY ROBERT CURR.

By the courtesy of W. I. Babcock, engineer and naval architect of Cleveland and New York, I herewith show a midship section No. 6, carefully worked out by Mr. Babcock and likely to be the future section of lake vessels.

This section is an improved structure over the hopper No. 5 and has the advantage of simpler work in the bottom.

Two watertight divisions, one on each side instead of the center keelson arrangement, is here shown, making three ballast tanks instead of two now in vogue on the great lakes. The side tanks are the whole depth of the vessel, the inner skins being run from the bottom plating to the spar deck, considerably increasing the longitudinal strength of the vessel and making a vessel of the unsinkable type.

The tank top is increased in thickness and additional stiffening added to same underneath.

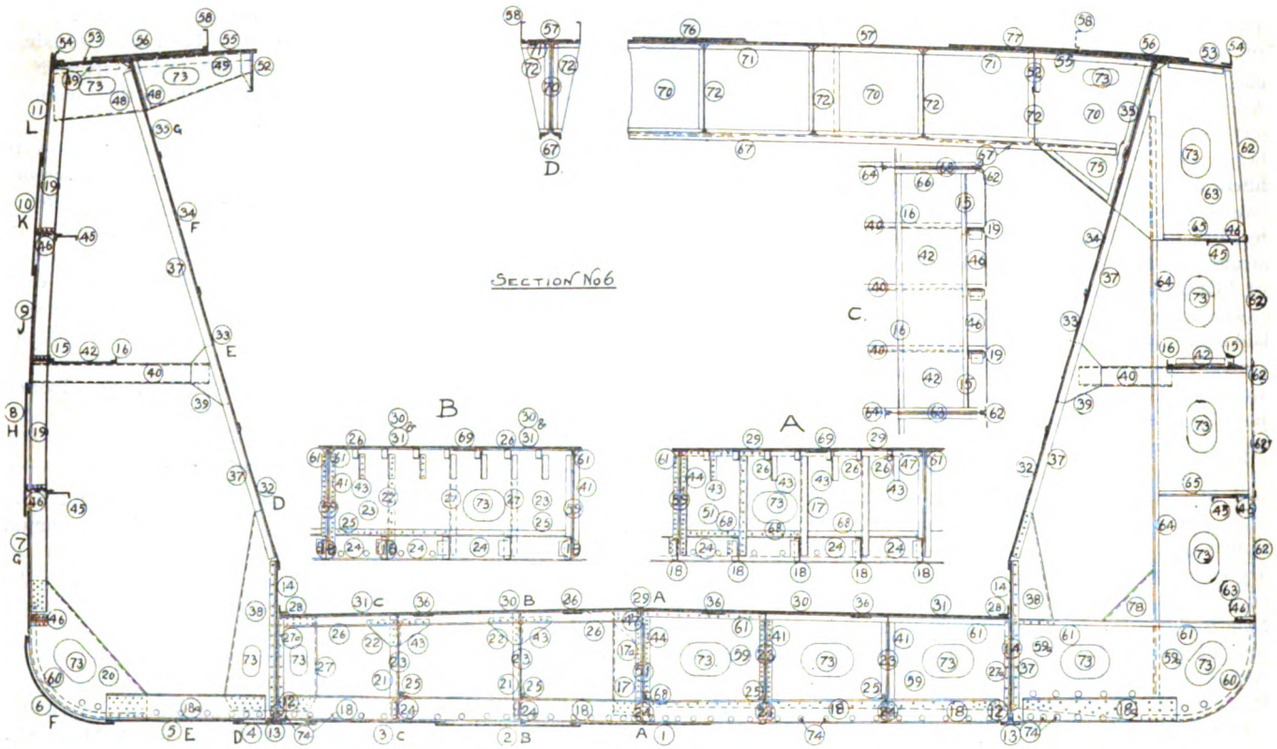
The bottom plating is slightly decreased in thickness, the whole idea being for the tank top to do the work; the bottom in the tank really has little to do except keep out the water.

The greatest advantages in Mr. Babcock's section over the others are the better distribution of materials, arrangement of tank top plating to resist damage caused by clams in unloading and a possible unsinkable ship through running the inner skins to the spar deck.

The hopper arrangement No. 5 is apt to be damaged above the side tank top, seeing it is only a short distance above the load water line when nothing would prevent the vessel from filling with water.

The following are the names of scantling as numbered on this vessel:

1. A strake.
2. B strake.
3. C strake.



4. D strake.
5. E strake.
6. Bilge strake.
7. G strake.
8. H strake.
9. J strake.
10. K strake.
11. Sheer strake.
12. Side girder bottom angles.
13. Side girder bottom angle liners.
14. Side girder plating.
15. Side stringer outer angles.
16. Side stringer inner angles.
17. Center girder bracket plates.

17a. Center girder bracket plate angles.

18. Channel floor in center tank.

18a. Channel floor in side tank.

19. Top side channel frame.
20. Bilge bracket.
21. Intercostal bottom girder plate stiffeners.
22. Intercostal bottom girder plates and brackets.
23. Intercostal bottom girder plates.
24. Intercostals to bottom plating.
25. Girder bottom angles.
26. Tank top stiffeners.
27. Bracket plates to side girders.

27a. Bracket plates to side girder angles.

28. Tank top continuous angles.
29. Tank top plating A strake.
30. Tank top plating B strake.
31. Tank top plating C strake.
32. Tank side plating D strake.
33. Tank side plating E strake.
34. Tank side plating F strake.
35. Tank side plating G strake.
36. Tank top seam straps.
37. Tank side stiffeners.
38. Tank side floor bracket plates.
39. Tank side channel brace bracket plates.
40. Tank side channel brace.
41. Girder end angles.
42. Side stringer plating.
43. Tank top stiffener brackets.
44. Floor angles to center girder.
45. Channel side stringers.
46. Channel side stringer intercostals.
47. Center girder top angles.
48. Spar deck beam bracket plates.
49. Spar deck beam bracket plate angles.
50. Side tank plating top angle.

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51. Center girder plating.
52. Flange plate girder under spar deck.
53. Outer spar deck stringer plating.
54. Spar deck stringer angle.
55. Inner spar deck stringer plating.
56. Spar deck stringer doubling.
57. Spar deck plating.
58. Spar deck hatch coaming.
59. Deep floor plates in center tank.
59a. Deep floor plates in side tank.
60. Bilge frame angles.
61. Top deep floor angles.
62. Web frame angles.
63. Web frame plates.
64. Web frame face angles.
65. Web plate stiffeners.
66. Side stringer plating and angles.
67. Arch beam face Z bars.
68. Center girder bottom angles.
69. Tank top plating butt straps.
70. Arch beam plates.
71. Arch beam plate deck angles.
72. Arch beam brackets to deck.
73. Lightening holes.
74. Limber holes.
75. Arch beam brackets to tank side.
76. Spar deck doubling at center.
77. Spar deck doubling at side.
78. Web frame brackets.

The erecting of this vessel could be carried out in sections in the bottom, the whole of the framing between the deep floors could be riveted ready for erecting. All the framing in the hoppers could be treated in the same way.

The erecting of this vessel would be simplified when so much of it could be put together on the ground and riveted together prior to erection.

The floor channel No. 18 runs across the ship in one piece from watertight girder No. 14 to girder No. 14. The tank top stiffener No. 26 runs across the ship in a similar way.

The girders Nos. 23 and 51 are only 12 feet long, so that the bottom framing, including the floors, tank top stiffeners, girders, girder stiffener and brackets, bottom angles, bracket plates Nos. 17 and 27, and intercostals to bottom, No. 24, could be all finished for 12 ft. and erected on top of bottom shell plating A, B, C and D. The deep plate floors are riveted to the channel floor and are solid between the side tank girders.

The side deep plate floor runs from the side girder to the bilge and riveted to the web plate at line of tank top.

The web plate is in one piece from the top of plate floor to top side stringer when the top plate fits up to the inner bulkhead and laps on to the lower part of the web plate.

All the riveting may be completed on the webs before erecting, thus effecting quite a saving in the cost of riveting.

The arch beams can be finished in the usual way by riveting same on ground, including the deck plating, doublings and hatch coamings.

A shows cross section of center girder.

B shows cross section of side girders.

D shows plan of side stringer on main deck line.

C shows cross section of arch beam.

MAKING TRADE FOR FOREIGN SHIPS.

BY WALTER J. BALLARD.

In the fiscal year ended June 30, last, the total export of American manufactures and American products reached a value of $1,834,786,357.

Of these exports the ocean carrying distribution was:

In foreign steamships	$1,499,633,257
In foreign sailing ships	35,325,996
Total exports carried in foreign ships	$1,534,959,253
In American steamships	110,760,868
In American sailing ships	7,699,918
Total exports carried in American ships	$ 118,460,786
Excess carried in foreign ships	1,416,498,467

In the same year our imports reached a value of $1,194,341,792. These were carried in:

Foreign steamships	$ 958,298,094
Foreign sailing ships	12,813,140
Total imports carried in foreign ships	$ 971,111,234
American steamships	145,101,373
American sailing ships	6,818,360
Total imports carried in American ships	$ 151,919,733
Excess carried in foreign ships	819,191,501

SUMMARY.

In foreign ships—exports	$1,534,959,253
In foreign ships—imports	971,111,234
Total American commerce in foreign ships	$2,506,070,487
In American ships—exports	118,460,786
In American ships—imports	151,919,733
Total American commerce in American ships	$ 270,380,519
Excess in favor of foreign ships	$2,235,689,968

In other words, less than 10 per cent of the $3,029,000,000 total American commerce in the year was carried in American ships. That is the way we make trade for foreign ships, paying their owners nearly $250,000,000 a year for carrying American made goods out and bringing American bought goods in. How long must we or can we stand it?

Col. Thomas W. Symons has been retired on his own application after 37 years' service in the engineer corps of the army. Col. Symons is well known on the great lakes. During late years, however, he has been stationed at Washington as superintendent of public buildings and grounds.

MERCURIAL AND ANEROID BAROMETERS.

There is a further advantage which may at times be taken of this known rotation of the winds, especially in lake navigation. A vessel on a weather shore, informed by her barometer that the storm center is moving rapidly, and that rapid shifts may therefore be expected, will often profit by lying to, anchoring under or hugging that shore, confident that the wind in shifting will afterwards afford her a continuous lee under the land.

Further Differences Between the Front and the Rear of the Storm.—In addition to the fall of the barometer and the southerly winds, the approach of a barometric depression is marked by a rise in temperature of 5 to 10 degrees Fahr.; by the excessive moisture of the atmosphere, shown by the small difference between the wet-and-dry bulb thermometer; and particularly by the increasing quantity and the character and motion of the clouds, these having a soft, oily look, and coming from a direction one or two points to the right of the wind.

To recapitulate, we have, then, as the distinguishing features of the—

Front of the Storm—

1. Falling barometer.
2. Southeasterly winds.
3. Rising temperature.
4. Increasing moisture (small difference between wet-and-dry bulbs).
5. Rain.
6. Clouds soft and veil-like.

Rear of the Storm—

1. Rising barometer.
2. Northwesterly winds.
3. Falling temperature.
4. Increasing dryness (large difference between wet-and-dry bulbs).
5. Rain ceasing.
6. Clouds hard and tending to break up.

When apprehensive of the weather, the mariner should make each of these points the subject of independent observation, not only once, but at hourly intervals. Having convinced himself that a storm is approaching, and having fixed his position to the best of his ability with regard to the storm center and its probable path, he is enabled to predict with some certainty what the direction of the coming winds and sea will be, to take due and seamanlike precautions and, if necessary, to seek shelter before his vessel has been damaged, instead of after.

Average Storm Track.—The path followed by the storm center in mov-

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ing eastward is known as the "storm track." By comparing the observations of many years, plotting the successive positions of the center of each storm as it approaches the lakes, and drawing the tracks, it becomes apparent that for each class of storms there is a certain strip or belt along which the storm center seems to travel in preference to any other. This belt is known as the "average storm track," and is shown for the great lakes and the country to the west in the small chart (Fig. 1). Occasionally a storm travels outside the general belt and takes an erratic course but it is seldom that one takes a direction differing materially from the general progressive movement of the majority. It is very necessary, however, that the average path should not be blindly accepted as the real path of any particular storm.

The great lakes region is in the direct course or path of storms which come from the northwestern, western and southwestern country behind it. The storms from the southwest are the most severe, but their centers generally pass over the Ohio valley, and the gale is often felt over only the southern portion of the lake region. In fact, a gale from the NE may blow for a couple of days in Chicago and hardly felt farther north than Milwaukee; and sometimes the center of the storm is so diverted toward the Atlantic coast that gales are felt only on the lower lakes during its passage. Sometimes storms that have their origin in the Gulf states move northeastward to New England. These storms usually develop great force and cause heavy gales over the entire lakes as far west as Duluth.

When the storm is central over the country lying south of Lake Michigan, or when the strong wind is due to the development of a low pressure area in that portion of the country, the wind on Lake Michigan (or north of the storm center), will in all probability be heavy from the NE, or out of that quadrant. When an ordinary vessel can leave Chicago and make progress down the lake with such a wind, the captain can count on the wind becoming more and more diminished in force the farther he gets down the lake. He is moving away from the storm's center, and the barometer is going up, or has been going up and is now steady. Occasionally northeasters are caused by the rapid development and movement of high-pressure areas over the lakes; and, in this case, the strong wind is first felt on Lake Superior.

During the autumn and spring, well-marked storms that appear centered over Iowa usually result in severe gales, generally from southeast, shifting to south, southwest and west. These, as a rule, pass with their centers directly over Lake Michigan and Lake Huron, and the force of the shifting gale near the central point is often quite dangerous. In the advance of such a storm the part of the lakes over which the storm is moving will experience southeasterly winds shifting to south and southwesterly; and that portion of the country lying in the rear of the storm will experience westerly and northwesterly gales; north of the storm center, easterly, northeasterly, northerly and northwesterly winds will prevail, and to the southward of the storm center, southerly, southwesterly and westerly gales will prevail.

Storms which cross with their centers over Lake Superior are seldom severe, the danger generally lying only in the shift to NW. The blow from southeast to southwest on Lake Superior affects but little the progress of vessels along the southern shore. A wind of from 40 to 50 miles off the land kicks up but little sea within a few miles of the coast, while these conditions render navigation practically impossible on the opposite shore. The force of the wind itself directly affects but little the progress of steamboats; and, consequently, if there is a lee, not much inconvenience is experienced. Where the wind has a full sweep a tremendous sea is the result and progress is well nigh impossible. In other words, it is the sea rather than the force of the wind that affects the progress of steam vessels.

The information sent out by the weather bureau as to forecasts, direction of winds, storm centers, etc., is of the utmost importance to the master, especially of lake vessels. Any means of predicting a coming storm, of foretelling the shifts of the wind, and the probability of a certain shore furnishing a continuous lee has a double value. Knowing the circular theory of the laws of storms, the shifting of the winds in different positions from the storm center, etc., and by closely following the weather charts from day to day, the mariner can keep himself informed at all times of the approach of any extensive atmospheric disturbance likely to endanger his vessel. Aside from this, he will often be able to make a long run along lee shores during very stormy weather by taking advantage of the shifts of the winds. He is able to do this by knowing the condition of the winds, whether he is in advance of the storm, to the right or left of it, or in the rear of it. In other words, knowing approximately the bearing of the storm center and his position from it, he knows the shifts of the wind to be expected and may take advantage of them.

A steamer leaving Buffalo in a southeaster, with the storm center in Iowa, for instance, might, by skirting the south shore of Lake Erie, have a lee to Detroit river. The wind will veer to south and southwest (being situated to the right or south of the track of storm center). The storm track will be across the southern portion of Lake Michigan, through central Michigan and the northern portion of Lake Huron, or approximately NE from Milwaukee. The wind will shift to south and southwest as the storm moves across the lakes, and by the time the steamer gets into Lake Huron, the blow should ordinarily be from the southwest to west. As the storm center is moving away from the ship as she proceeds up the west shore of Lake Huron, or what is the same thing as being in the rear of a storm moving toward the east, the wind will shift into the northwest, but this shift may not occur until the vessel has safely passed through the Straits of Mackinac; in which case the master will take the north passage and hug the west shore of Lake Michigan to Chicago. By the time Chicago is reached the force of the wind must be near spent.

Bound from Chicago to Buffalo at the same time and under the same conditions as prevailed at Buffalo, the master should seek a lee as soon as possible and get under the east shore of Lake Michigan. With the wind shifting from southeast to high southerly there is not much choice, only that he has the full force of the wind astern of him, and can scud before it. By the time he gets through the straits the wind will be shifting to the westward, thus affording a lee as he goes down the west shore of Huron; and by skirting the north shore of Lake Erie, protection from the gale as it shifts into the northwest will be afforded.

Supposing a master leaves Chicago during a northeaster with the storm centered over southern Illinois. If he deems it advisable to leave, which under many cases is dangerous and lack-

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ing in economy, he should seek the lee of the east shore, but with the indea of making harbor in case he gets caught in a northerly or northwest gale before reaching the Straits of Mackinac. The wind is sure to back up from NE to north and northwest for one situated north and west from the storm's center. In case Lake Huron is reached before the wind gets into the north and northwest, the west shore of Lake Huron will afford a safe lee, as will also the north shore of Lake Erie.

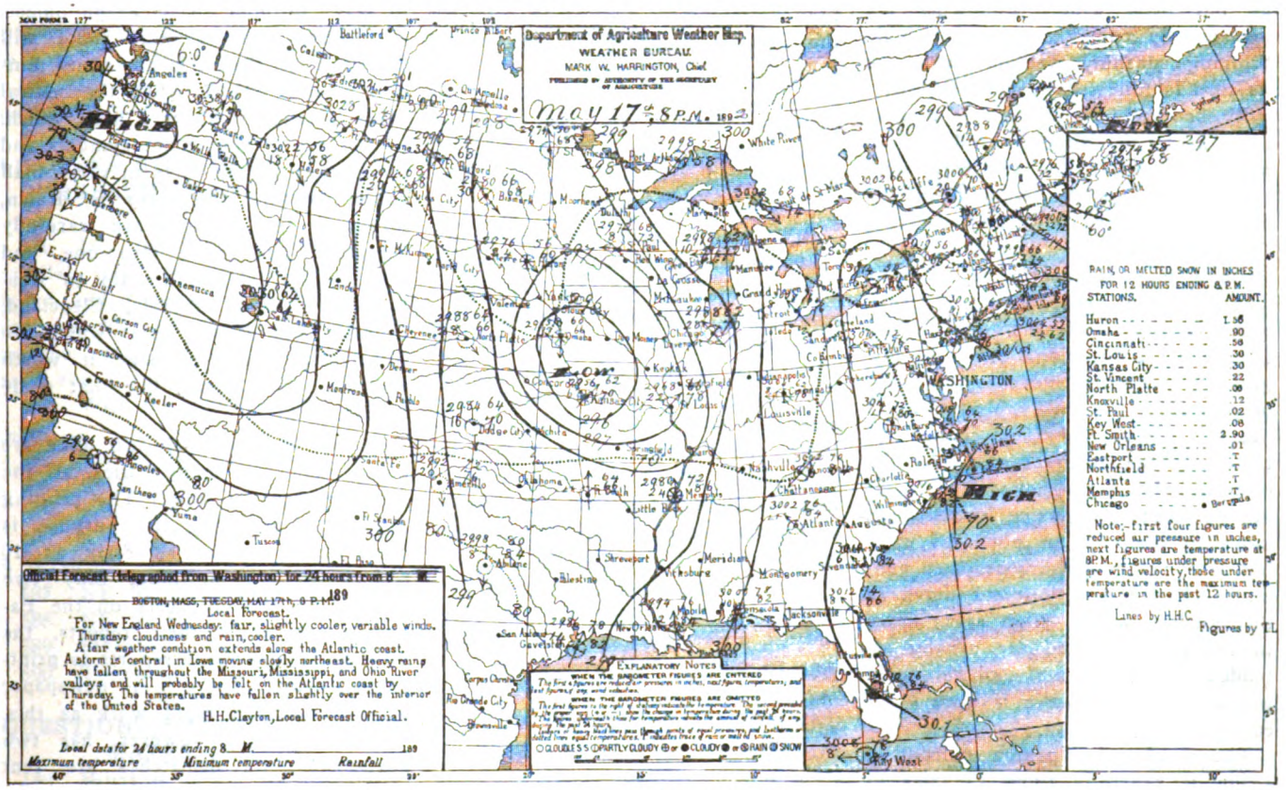
One should always bear in mind that a southeaster always goes around to west and northwest by way of south, and a northeaster "backs" to northwest by way of north. It is very often that the wind after a southeaster does not go further north than west.

"Backing" means that the winds shift against the movement of the hands of a clock, or to the left; while "veering" means a shift in the direction the hands of a clock revolve, or to the right.

Another very important consideration on the part of shipmasters in anticipating the direction and velocity of the wind a couple of days in advance when bound to Lake Erie ports is to figure on the probable depth of the water over the Lime Kiln Crossing. Winds from the northeast to south will back up the water in the western end of Lake Erie, consequently raising the water at the Crossing. Northwest and west winds have the reverse effect, piling up the water at the eastern end of the lake. The decrease in the stage of water from this cause has been as much as 15 in. If a vessel is loaded to the limit of the mean stage of water over the crossing, and this mean stage is diminished by this cause, it means a wait until the water returns to its normal stage. With rapidly shifting winds from one quadrant to another, the average stage of water can be counted on; but with certain well-marked winds a rise and fall can be expected.

This map presents an outline of the United States and Canada, showing the stations where weather observations are taken daily at 8 a. m. and 8 p. m., seventy-fifth meridian time. These observations consist of readings of the barometer, thermometer (dry and wet), directions and velocity of wind, state of weather, amount, kind and direction of the clouds, and amount of rain or snow; they are telegraphed to Washington and to many of the weather bureau stations throughout the country for publication on the maps. Solid lines called "isobars," are drawn through points having the same atmospheric pressure; a separate line being drawn for each difference of one-tenth of an inch in the height of the barometer. Dotted lines, called "isotherms," connecting places having the same temperature, are drawn for each 10 degrees of the thermometer. Heavy dotted lines, inclosing areas where a decided change in temperature has occurred within the last 24 hours, are sometimes added. The direction of the wind is indicated by an arrow flying with the wind, or opposite to the ordinary vane. The state of weather—whether clear, partly cloudy, cloudy, raining, or snowing—is indicated by the circular symbol. Shaded areas, when used, show where rain or snow has fallen since the last observation.

The general movement of storms in the United States is from west to east, similar to a series of atmospheric waves of which the crests are designated on the map "Highs," and the troughs or depressions "Lows." These alternating highs and lows have an average easterly movement of about 600 miles per day.


Department of Agriculture Weather Bur.
WEATHER BUREAU
MARK W. HARRINGTON, Chief
May 17th 8 P.M. 189
RAIN OR MELTED SNOW IN INCHES FOR 12 HOURS ENDING 8 P.M.
STATIONS. AMOUNT.
Huron .16
Omaha .90
Cincinnati .58
St. Louis .30
Kansas City .30
St. Vincent .22
North Platte .06
Knoxville .12
St. Paul .02
Key West .08
Ft. Smith 2.90
New Orleans .01
Eastport T
Northfield T
Atlanta T
Memphis T
Chicago 0
Note:-first four figures are reduced air pressure in inches, next figures are temperature at 8P.M., figures under pressure are wind velocity, those under temperature are the maximum temperature in the past 12 hours.
Lines by H.H.C.
Figures by T.L.
Official Forecast (telegraphed from Washington) for 24 hours from 8 P.M.
BOSTON, MASS., TUESDAY, MAY 17th, 8 P.M. 189
Local forecast.
For New England Wednesday: fair, slightly cooler, variable winds.
Thursday: cloudiness and rain, cooler.
A fair weather condition extends along the Atlantic coast.
A storm is central in Iowa moving slowly northeast. Heavy rains have fallen throughout the Missouri, Mississippi, and Ohio River valleys and will probably be felt on the Atlantic coast by Thursday. The temperatures have fallen slightly over the interior of the United States.
H.H.Clayton, Local Forecast Official.
Local data for 24 hours ending 8 P.M. 189
Maximum temperature Minimum temperature Rainfall
EXPLANATORY NOTES
WHEN THE BAROMETER FIGURES ARE OMITTED
WHEN THE BAROMETER FIGURES ARE ENTERED
CLOUDLESS PARTLY CLOUDY CLOUDY RAIN SNOW
HIGH
WASHINGTON
Key West

COPY OF ONE OF THE DAILY WEATHER-MAPS.

WEATHER BUREAU.
(Explanation of the daily weathermap.)

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High winds, with rain or snow, usually precede the low area, often extending to a distance of 600 miles to the eastward of the center of the storm. In advance of the low the winds are generally southerly, and consequently bring high temperature. When the center of the low passes to the east of a place the wind at once shifts to the west or northwest, bringing low temperature. The temperature on a given parallel west of the low may be reasonably looked for on the same parallel to the east when the low has passed, and frost will occur along and north of an "isotherm" of about 40 degrees, if the night is clear and there be but little wind. Following the low usually comes an area of high, bringing sunshiny weather, which in its turn is followed by another low.

By bearing in mind a few general rules as to the direction and rate of movement of the low and high, with the blowing of the wind from the high towards the low, and studying the map carefully, coming weather changes may frequently be foreseen. The centers of lows do not, as a rule, move across isotherms, but follow their general direction. Areas of low pressure frequently move to the south of east from the Rocky Mountains to the Mississippi and then change direction to the north of east over the eastern half of the country. Storms in the Gulf of Mexico occasionally move to the west or north of west, but after reaching the coast they generally change direction and move to the northeastward. High areas move to the southeast and are usually attended by fair and cool or cold weather. A cold wave is always accompanied by a high.

The cloud and rain area in front of a low is generally about the size of the latter and oval, with the west side touching the center of the low in advance of which it progresses.

When the isotherms run nearly east and west, no decided change in temperature will occur. If the isotherms directly west of a place incline from northwest to southeast, it will be warmer; if from northeast to southwest, it will be colder. Southerly to easterly winds prevail west of a nearly north and south line passing through the middle of a high, also east of a like line passing through the middle of a low. Northerly to westerly winds occur west of a nearly north and south line passing through the middle of a low and also east of a similar one through the middle of a high.

An absence of decided waves of high or troughs of low pressure indicates a continuance of existing weather which will last till later maps show a change, usually first appearing in the west.

The temperature of the air as published on the map is observed with a dry-bulb thermometer, and also with a wet-bulb thermometer—that is, one whose bulb is covered with a moist wrapping. The evaporation from the wetted surface, if the air is not saturated with moisture, is more rapid than from the dry bulb, in proportion to the relative amount of aqueous vapor, and this produces a lower temperature. The difference of temperature between the readings of these two thermometers suffices to compute the relative humidity of the atmosphere. The temperature of the wet bulb is also called the sensible temperature, because the sensation of heat on the skin agrees more closely with its indications than with those of the dry thermometer.

At first the map seems hard to read, because there are such strange signs on it; but these soon become as familiar as the letters of the alphabet, and one then sees on it plain pictures of storms, clouds and sunshine, rain and snow, hot and cold waves. Almost at a glance one sees the changes come, and the little map, once fully understood, is much more reliable than the best barometer any captain ever carried to sea in his ship. What makes it so interesting is the fact that it comes fresh every day, always with some new story to tell, and the government gets the information so quickly that you know each day just what the weather is like on that very day in California or Ohio, in Buffalo, or Chicago, or Duluth—in fact, in every state and almost every city.

Of course, if we had to wait for the map to come from Washington, it would tell only an old story on its arrival; so a plan has been devised which avoids all delay. It is a very expensive plan, but a very simple one, and well worth all the money it costs. The government pays the bill willingly. The method is this: The weather bureau has agents, who are called "observers," at all the places throughout the country from which it desires daily information. At the moment the clock, set to standard time, strikes 8 in Buffalo—that is, eastern standard time; 7 o'clock in Chicago—central standard time; 6 o'clock at Denver—mountain time; and 5 o'clock at San Francisco—Pacific time—these observers go to their instruments and write down what is recorded at that instant. These instruments tell them the temperature, the pressure of the air (the reading of the barometer), the direction of the wind, and how many miles an hour it is moving, and the observers need only use their eyes to find out whether it is cloudy or clear or raining. They tell by the self-registering thermometer how cold it was during the night—that is, the lowest temperature. Then the observers go to their telegraph instruments and forward their reports at once to the central office at Washington.

Government messages have "right of way" through all telegraph offices, and other business must stand still for them; so that it is not many minutes after 8 o'clock when the central office is ready to make a map, which, by the use of convenient symbols and lines, gives all the facts in very small space. Before this map is drawn, however, the reports are carefully compared and made into one, and are sent by telegraph again to Boston, New York, Buffalo, Cleveland, Chicago, and all the cities which are sufficiently large to make it worth while to print a map like that made in Washington.

In this way maps all just alike are being made in many cities at the same moment of time. The printing machinery used for the purpose is very rapid. Often as early as 10 o'clock in the morning, only two hours after the observers on the Pacific coast wrote their reports, the map containing those reports is printed in Boston. There is no newspaper able to do such rapid work as this. The government, however, has two advantages; its dispatches are sent before even press dispatches, and the machinery for printing requires less time than the type-setting and printing work of a newspaper.

As storms usually move from west to east so that when it is desired to know what kind of weather we are going to have the next day at a certain place it is only necessary to study the weather map, and note which portion of the country the storm is central over. The map from the day before will tell you which way the storm is moving. If we find a storm central over the western states and moving toward us at a certain number of miles each day, we can fix, approximately, the time when the storm will reach us. In the same way rain and cold may be looked for.

(To be Continued.)

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QUESTIONS FOR WHEELSMEN AND WATCHMEN.

581. How would you take a course off the chart with the parallel rulers?

582. How would you measure the distance?

583. What is the reverse of N E ½ E?

584. What is the reverse of WSW ⅛ W?

585. How many ⅝ point courses are there?

586. Name them.

587. What point is ⅝-pt. to the starboard of NE ⅝ E?

588. If you were to port 1 2/8 points from NE ¾ N, what point would it bring you to?

589. Would you have to starboard or port to go from E by N to ENE?

590. Is NW ½ W to the port or starboard of NW ⅛ N?

ANSWERS TO QUESTIONS FOR WHEELSMEN AND WATCHMEN.

581. Lay the beveled edge of the parallel ruler on the points to be sailed and run them to the nearest compass rose. Get the edge of rule on the center of compass rose and read the course.

582. With the dividers and scale of miles.

583. SW ½ W.

584. ENE ⅛ E.

585. Four.

586. N ⅝ E, N ⅝ W, S ⅝E and S ⅝ W.

587. NE by E ¼ E.

588. NE ½ E.

589. Starboard.

590. To port.

QUESTIONS FOR MASTERS AND MATES.—NO. 10.

146. What is meant by the portative force of a magnet?

147. Two magnets of equal size, such as two adjusting magnets, how could you put them together so as to destroy or neturalize their magnetism?

148. What is an isogonic line?

149. What is the difference between an isogonic line and a line of equal variation?

150. What is an agonic line?

151. Is there an agonic line passing thorugh the lake region?

152. How does a compass point on this agonic line?

153. Does a magnet lose any of its force by being incased in brass or copper, such as adjusting magnets?

154. What effect has a brass or copper casing as to the portative force of a magnet?

155. What is meant by attraction across bodies?

156. Will attraction assert itself through wood, brass, glass, etc.?

157. Is it possible to intercept magnetism by placing wood, brass and like substances between the compass and the iron or steel creating the disturbing force?

158. Does a magnet covered with wood have the same amount of magnetic force it would were it not covered with wood?

159. What are magnetic charts?

ANSWERS TO QUESTIONS FOR MASTERS AND MATES.—NO. 10.

146. Lifting power. The weight a magnet can support.

147. Place them side by side with poles of opposite names together.

148. A line of equal variation.

149. No difference.

150. Line of no variation.

151. Yes.

152. True north.

153. No.

154. It diminishes it.

155. The force of a magnet exerts itself across or through bodies that may be interposed. It still acts as a magnet if encased in wood, brass, canvas, etc.

156. Yes.

157. No.

158. Yes.

159. Maps on which are printed lines showing the distribution of the earth's magnetism.

MEXICO IMPROVING WATERWAYS.

Washington, Aug. 25.—The development of natural resources by the improvement of waterways is receiving attention in Mexico as well as in the United States. Mexico, however, is less fortunate in that respect than this country because it has few waterways to develop. It has no large rivers, and its coast, aggregating 6,000 miles in length, has comparatively few inlets and lagoons.

Consul P. M. Griffith reports progress on the coastal canal which will connect Tampico and Tuxpam on the Gulf coast.

The canal will be 120 miles long, 5 ft. deep, 40 ft. wide, and will cost about $2,000,000. The Mexican government is supplying the funds to the American contractor who expects to complete the work in two years. He has an excavating outfit and 200 men ready to take up the remaining section of the canal.

The waterway will follow a series of lagoons very similar to many along the Atlantic coast of the United States. The country behind has no outlet at present, and as it is very rich agriculturally, it is expected that the opening of the canal will be of great value. The northern terminus of the canal will be about 300 miles south of the southernmost point of Texas.

SANDSUCKER AMERICA LAUNCHED.

The Empire Ship Building Company, of Buffalo, last Friday launched the big steel sandsucker which was built for the Builders' Supply & Sand Co., of Erie, Pa. The launching was witnessed by a large number of Buffalo and Erie people. Numbered among those present were: President John F. Malone and Secretary Palmer, of the Empire Ship Building Co., and Robert McClenathan, R. A. Cooney and Charles B. Lechner, of the Builders' Supply & Sand Co., of Erie, Pa. Miss Mary B. Lechner, daughter of the general manager of the company, broke the bottle and christened the craft "America." Later Mr. Malone and Mr. Lechner addressed the guests and then the affair was concluded by a luncheon.

The cableship Burnside has recently completed the laying of an extension of the Washington-Alaskan military and telegraph system from the north side of Montague Island to Cordova, Alaska, where an office was opened on Aug. 12. This is expected to prove of great convenience, not only to the army, but to the commercial interests of Alaska.

SHIP BUILDING DURING JULY.

The bureau of navigation reports 101 sail and steam vessels of 7,178 gross tons were built in the United States and officially numbered during July, 1908, as follows:

	WOOD				STEEL				TOTAL	
	Sail		Steam		Sail		Steam			
	No.	Gross	No.	Gross	No.	Gross	No.	Gross	No.	Gross
Atlantic and Gulf	11	2,712	43	802	..	.....	1	123	55	3,637
Porto Rico	....	.....	....	.....	..	.....	....	.....	....	.....
Pacific	1	14	20	997	....	.....	....	.....	21	1,011
Hawaii	....	.....	....	.....	..	.....	....	.....	....	.....
Great Lakes	....	.....	5	72	....	.....	2	2,161	7	2 233
Western Rivers	....	.....	18	297	..	.....	....	.....	18	297
Total	12	2 726	86	2,168	....	.....	3	2,284	101	7,173

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ATLANTIC COAST GOSSIP.

Office of the MARINE REVIEW,
Room 1005, No. 90 West St.,
New York City.

The Cunard liner, Lusitania, arrived at New York last week with four speed records to her credit, being still in the record breaking business, and having things pretty much her own way. The course from Daunt's Rock to Sandy Hook Lightship of 2,781 miles was covered at an average speed of 25.05 knots, the best previous record being her own, made last November, of 25.01 knots. The passage was made in exactly 4 days and 15 hours, which is 3 hours and 40 minutes better than her time record heretofore. From Aug. 16 at noon, to the 17th, at noon, she covered 650 miles at an average speed of 25.66 knots, her best previous run, made in July, being 643 miles. Her daily runs, from noon to noon, were: Sunday, 21 miles; Monday, 650; Tuesday, 631; Wednesday, 623, and Thursday at noon, 610. From noon Thursday to 9:30 p. m., she covered 246 miles.

The German steamship Kronprinz Wilhelm, of the North German Lloyd, and the British freight steamer Crown of Castile, which were in collision in New York harbor on March 18, have been declared equally at fault in a decision rendered recently by Judge Hough, of the United States District Court, the damages and costs to be divided between the ships. It was not necessary, according to Judge Hough, for the Kronprinz Wilhelm to anchor in the fairway in the fog, and the Crown of Castile's speed was immoderate under the circumstances, her pilot and master being aware that the liner was directly ahead.

On Aug. 23 an order was issued by the postmaster general putting into effect the postage rate of two cents per ounce for letters mailed in this country for the United Kingdom and Ireland, beginning Oct. 1.

The bark Good News, of Philadelphia, arrived at Tacoma, Wash., last week, after a voyage extending over an extraordinary space of time. The Good News, mentioned recently in this column as having been falsely reported, sailed from Philadelphia for Tacoma just seven months ago with a cargo of explosives. During the entire voyage she was never reported as having been sighted, and grave fears were entertained of her safety. It is believed that the loss of her foremast was accountable for the unusual length of the voyage. The Good News was formerly a coffee trader between Baltimore and Brazil.

In future all vessels carrying Italian immigrants must comply with the laws of that country. The captain of every steamship carrying more than 50 emigrants to Italy must, according to one of the new laws, have a permit from the Italian Consul at New York to certify that he has complied with the requirements of the law. All particulars must be entered in the permit by the consul, and any captain sailing without such permit will be punished. The regular liners carrying passengers to and from New York and Naples, which comply with the Italian emigration laws and have a royal commissioner on board who is a naval surgeon, are exempt from the more rigid inspection.

The Red Star liner Kroonland, from Antwerp and Dover, and the Holland-America liner Statendam, from Rotterdam, arrived at Sandy Hook on Monday, the vessels having been in sight of one another during the entire voyage, and arriving at the Hook forty-five minutes apart. The Kroonland, which passed out of the English channel much astern of the Statendam, was first to enter the harbor.

The British steamship Mount Temple, which left Newport News last Saturday for Montreal, will soon return to service. The Mount Temple went ashore on La Have, Ironbound Island, on December 2, while bound to St. John, N. B., from Antwerp. She was considered a total loss, and it was due practically to the efforts of John A. Boyt, of Philadelphia, that the vessel was floated and towed to St. John. Mr. Boyt represents the London Salvage Association. Ninety thousand dollars were spent at St. Johns before the vessel could leave for Newport News, and $135,000 at the yards in Virginia. The Mount Temple is owned by the Canadian Pacific Railroad.

William Weighe, member of the board of inquiry of the immigration bureau, of Ellis Island, N. Y., died this week at his Pittsburg home after a short illness. He was taken ill with indigestion at New York last week and was advised to return home. Mr. Weighe was formerly president of the Amalgamated Association of Iron, Steel and Tin Workers of the United States.

According to Joseph H. Hasskari, assistant director of the department of wharves, docks and ferries, of Philadelphia, the wharves of that city are a hundred years behind the times. Incidentally, not only Philadelphia, but the whole United States seems to have been in a rut for a hundred years, so far as pier-making goes. Mr. Hasskari bases his statements on his travels and observations while spending the past two months in Europe. In his report to Mayor Reyburn he will have a number of very valuable recommendations to make.

Spain is offering large subsidies to native ship owners for important trades between the mother country and abroad. There are six lines with itineraries particularized in the schedule. For the Mediterranean-New York route, the sum of $302,200 is allotted to the three steamers for one departure monthly between Barcelona and New York. The ships must be of an average tonnage of 9,000 and 6,000 minimum, and of a speed in the trials of 14.38 miles average.

The matters being discussed at the conference of the North Atlantic shipping companies in London this week will be confined to North Atlantic business. The Italian steamship lines are not represented, as the question of the Mediterranean traffic will not be brought up.

While bound from St. John, N. B., to Elizabethport, N. J., the schooner Three Sisters ran ashore on Baker's Island, coast of Maine, where she became a total wreck, the cargo of lumber being also lost. The crew were rescued with difficulty. The Three Sisters was built at Milford, Del., in 1872, and at the time of her loss hailed from Boston.

The German steamship Pennoil, from Philadelphia for Hamburg, has arrived at that port with her machinery broken down and a broken propeller.

AROUND THE GREAT LAKES.

The steamer Augustus B. Wolvin went in commission at Duluth on Wednesday of this week.

The steamers Selwyn Eddy and George H. Russel were put in commission at Milwaukee this week.

The men employed on the Clarkson coal dock at Ashland struck for higher wages last week.

The steamer Leland S. DeGraff, loaded with ore, ran aground at Windmill Point, Lake Erie, on Tuesday of this week. She will have to be lightered.

The day trips of the D. & C. line between Cleveland and Detroit will close on Saturday of this week. There will, however, be a special day trip on Labor day, Sept. 7.

The schooner Jessie Martin, which sprung a leak on Lake Michigan during a storm last week, has been picked up by the life saving crew of Manitowoc. She is broken in two.

Bids were opened on Monday of this week at the office of the United States engineer at Detroit for furnishing 10,000 barrels of cement for the Sault lock job. Nine bids were re-

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ceived, the lowest being that of $1 per barrel by the Burt Portland Cement Co., Bellevue, Mich. Only two bids were received for the work of excavation, one from the Great Lakes Dredge & Dock Co., Cleveland, at 43 cents per cubic yard, and the other from F. L. Dulocher at Sault Ste. Marie, at 47¼ cents per cubic yard.

While lying at the mouth of Sturgeon Bay waiting for the steamer Mohegan to pick her up, the barge, Annabel Wilson was run into by Carferry No. 1 in tow of the tug Fisher. The stern of the Wilson was crushed in.

Three scows, belonging to the Lake Erie Dredging Co., Buffalo, broke away from the tug Fred A. Lee while being towed from Erie to Buffalo last Monday and ran ashore near Dunkirk.

While being towed down the Cuyahoga river from the Irishtown coal dock Aug. 12, the stern of the steamer Wm. Livingstone hit the fishing tug Charm and damaged her house.

H. H. Thompson, diver, has succeeded in raising part of the machinery of the steamer Hesper which was sunk near Beaver Bay several years ago. He bought the wreck some time since from the underwriters.

The little passenger steamer Plow Boy ran aground at the entrance to Portage Lake at midnight on Tuesday last. The passengers were taken off and carried to Houghton. The Plow Boy was released, uninjured, the following day.

The steamer Oregon, loaded with pulpwood which ran on Diment shoal, North Channel, last Monday night, caught fire and was totally destroyed. Part of the cargo was saved. The Oregon was owned by J. W. Squires, of Michigan City, Ind.

The Pittsburg Coal Co.'s fuel dock at Point Aux Frene in Mud Lake collapsed last week. The north pockets and derricks were thrown into the water. John A. Donaldson, general agent for the company, went to inspect the damage.

Capt. A. C. Bartlett, an old time vessel master on the great lakes, died last week. Capt. Bartlett began his career as a sailor when a boy in the early forties and continued until 1882. Among old time craft which he sailed were the schooners Magic, Champion, Albatross, C. Y. Richman, Lark, J. S. Newhouse and Monteagle and the steamers Old Concord, Comet, Benton, Norman, St. Paul, Messenger, Skylark and Lora.

Major Charles Kellar, upon his return from the annual inspection of the lighthouses in his district this week reported that the new lighthouse building on Rock of Ages, at the westerly end of Isle Royale, Lake Superior, is practically completed. Only the interior work on the lighthouse and the placing of the beacon remains to be done, and it is expected that the light will be placed in operation by Oct. 1.

President Livingstone, of the Lake Carriers' Association, is advised by the state department that the Canadian government will provide and maintain a light vessel at Southeast Shoal, Lake Erie. The lightship Kewaunee, at present stationed at this shoal, is maintained privately by the Lake Carriers' Association.

SECOND BUSINESS MEN'S CONFERENCE.

Another conference of the business interests of the port of New York was held recently at which the commercial development of the port was discussed with a view to providing remedies for existing evils such as lack of terminal facilities, excessive port charges and unfair discriminations, which have led to the falling off of a great portion of the grain trade formerly going to that port but now centered in Montreal. Among the ideas advanced was one that the state of New York should own the waterfront of the city of New York.

The following resolutions were adopted:

(1) That this conference directs attention to the lack of proper canal, rail and terminal facilities to handle the commerce of the port and state of New York, to excessive port and terminal charges, inflicting undue and unnecessary burdens upon our commerce, and to the existence of other unfair discriminations, which all combine to divert a large portion of the commerce naturally tributary to us, in consequence of which all interests are made to suffer.

(2) That this conference hereby appeals to the nominating conventions of the various political parties, that only such persons shall be deemed worthy to fill the offices of governor, lieutenant governor, senator and assemblyman and the administrative offices of the state who, in addition to other high qualifications, shall be zealous to bring about a repeal of laws now obstructing the commercial development of the port and state of New York and who will do all in their power to secure the enactment of laws requisite to hasten the restoration of our commercial prosperity.

(3) That the president, together with at least two members to be appointed by him, shall constitute the committee on finance, who shall have power in such manner as they may deem wise and expedient to secure funds to carry out the objects of the conference.

ITEMS OF GENERAL INTEREST.

The Danish bark Emilie recently arrived at New York under jury rig, having run into a gale off Cape Hatteras in which she lost her deck load of mahogany, her masts and a goodly share of her canvas. The Emilie was bound from Santa Cruz to Havre when overtaken and left helpless by the storm.

The army engineers engaged in the survey of the Panama railroad have located it in such a manner that it is expected to lessen the cost of changing its route to accommodate the canal by $781,000. A synopsis of Col. Goethals' annual report contains this statement as well as a statement to the effect that more than a million dollars has been saved by the satisfactory settlements that have been made with persons owning land which is to be appropriated for canal purposes. Instead of costing $2,000,000 the assessments will aggregate only $250,000.

The navy department is soon to invite bids for the construction of ten oil-burning torpedo boat destroyers of the swiftest and most efficient type, not more than three of the vessels to be built at any one plant. The limit of cost for each vessel has been placed at $800,000. The new battleships provided for at the last session of congress are also to have tanks for carrying oil fuel although for ordinary steaming coal is to be used, the oil being used only when extraordinary speed is desired. The government has previously hesitated to make any practical use of crude petroleum for fuel, although it is in high favor by steamship owners on the Pacific coast, many vessels having been fitted with the apparatus for its use in the last few years.

A new Italian steamship law provides that the captain of every steamship carrying more than 50 emigrants to Italy must have a permit from the Italian consul at New York before sailing to certify that he has complied with the requirements of the law with respect to space on deck and below as well as in the food supplied. All particulars must be entered on the permit by the consul and any captain sailing without such a permit will be punishable. Consul General Annibale Massiglia, of the port of New York, began the enforcement of this regulation recently by a thorough inspection of the Cunarder Pannonia and the Austro-American liner Argentina.

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LUSITANIA BREAKS RECORD AGAIN.

The Cunarder Lusitania has again broken the world's record for fast steaming. The great ship made the passage from Daunt's Rock to Sandy Hook, over the short course of 2,780 knots, in the remarkable time of 4 days 15 hours and 25 minutes. Her former record, which was also an unbeaten one, was 4 days 18 hours and 40 minutes, and the steamer by her performance has lowered that mark by 3 hours and 15 minutes.

In addition to the honor of establishing one world's record for time of passage, the great turbine flier has put up the figures for 24 hours to a point where many of those who have been watching the performances of steam vessels never expected to see them. This record, another world's record, was made during the 24 hours that ended at noon on Monday. The great liner reeled off in that time 650 knots. Her best previous day's run was 643 knots, made on July 6.

The Lusitania has come through comparatively smooth seas and with the best of weather accompanying her. Tuned up by her many record trips of the spring and summer, Capt. J. B. Watt crowded on all steam for a record-breaking run before she was fairly past Daunt's Rock. The vessel left Liverpool on Aug. 15 and got to Queenstown in time to take on mails and passengers and get away on her over-sea run in the morning.

Daunt's Rock is taken as the starting point for vessels from Queenstown, and the giant Lusitania passed the starting place at 11:35 A. M. Sunday morning. She got a flying start, and as she steamed past Rock she was cutting through the sea at the rate of 22.91 knots an hour and she was making a clean cut through a fair sea with the water falling away from her cutwater in a long white line. She was only warming up for her record-breaking gait, and she soon was flying westward almost at the speed of a torpedo boat.

Once fairly headed away from the Irish coast she struck a smarter pace, and from noon Sunday to noon Monday she had logged 650 knots, seven knots more than she had ever made before. In doing this she had made an average speed of 25.66 knots for the twenty-four hours. The run ended at noon Tuesday was slightly lower, but still at a high rate of speed—631 knots, and at an average of 25.21 knots.

The Lusitania's best previous performance was made last November, when the short course was still in use. As the season advanced the Lusitania and her sister ship, the Mauretania, with the other liners, took to the long route, 2,889 knots, to avoid danger from icebergs. Then both vessels "tuned up" and began a series of record-breaking performances.

Now they have again taken to the southern route—the short course—and the great ambition of the Cunard Line is to have them get to Sandy Hook in time to come up to their pier and land their passengers on Thursday night. To this end they are striving, and it is certain that with a few more hours clipped from their records they will make the trip from Daunt's Rock to Sandy Hook in time to land on Thursday night.

SHIP YARD NOTES.

The steamer D. T. Lane, building for the Campbell's Creek Coal Co., Point Pleasant, W. Va., was launched at Dana-on-Kanawha on Saturday, Aug. 22.

The Maryland Steel Co., Sparrow's Point, Md., has been awarded contract by the Isthmian Canal Commission for the construction of a rock drill barge for submarine work. The barge, which is to be shipped to the Isthmus in knocked down condition, is to be built of steel and will be of the following dimensions: Length, 112 ft.; beam, 36 ft.; depth of hold, 8 ft. The company's bid was $34,000.

The Harlan & Hollingsworth Corp., Wilmington, Del., has announced that in conjunction with the Bethlehem Steel Co., it will build a plant for the manufacture of steel passenger coaches and all kinds of steel freight cars. The Harlan & Hollingsworth Corp. has built wooden cars for a great many years in addition to carrying on its great ship building business.

The Moran Co., Seattle, Wash., has preparations under way for enlarging its ship building plant to include the production of structural steel and a fund of $500,000 has been set aside for the purchase of machinery to be used in its manufacture. It is believed that the increased use of steel in the construction of tall buildings throughout the northwest will furnish a lucrative market for the product.

The steamer Dallas is towing the United States revenue cutter Fessenden from Baltimore to Toledo, the Fessenden having been purchased by George Craig, of that city.

The Union Petroleum Co. will build a new pier in front of its property at Marcus Hook. The new pier will be 450 ft. wide and will extend 150 ft. beyond the bulkhead line. Its outer face will be protected by concrete.

The auxiliary schooner yacht Haida, owned by Max Fleischman, recently ran down and almost cut in half the steam launch Nathalie, owned by the Robbins Dry Dock Co., of Brooklyn.

SUMMARY OF NAVAL CONSTRUCTION.

The monthly summary of naval construction, issued by the bureau of construction and repairs, shows the following progress upon vessels:

Name of Vessel.	Building at—	—1908— Per cent of completion. July 1.	Aug. 1.
BATTLESHIPS.			
South Carolina	Wm. Cramp & Sons	51.9	55.0
Michigan	New York S. B. Co.	57.2	60.4
Delaware	Newport News S. B. Co.	31.6	35.3
North Dakota	Fore River S. B. Co.	40.5	45.7
SCOUT CRUISERS.			
Salem	Fore River S. B. Co.	98.9	100.0*
TORPEDO BOAT DESTROYERS.			
T. B. Destroyer No. 17	Wm. Cramp & Sons	31.1	38.7
T. B. Destroyer No. 18	Wm. Cramp & Sons	26.9	35.7
T. B. Destroyer No. 19	New York S. B. Co.	33.8	42.2
T. B. Destroyer No. 20	Bath Iron Works	13.0	14.0
T. B. Destroyer No. 21	Bath Iron Works	13.0	14.0
SUBMARINE TORPEDO BOATS.			
Submarine T. B. No. 13	Fore River S. B. Co.	49.3	51.9
Submarine T. B. No. 14	Fore River S. B. Co.	49.4	51.9
Submarine T. B. No. 15	Fore River S. B. Co.	48.6	50.9
Submarine T. B. No. 16	Fore River S. B. Co.	48.8	51.1
Submarine T. B. No. 17	Fore River S. B. Co.	35.8	42.4
Submarine T. B. No. 18	Fore River S. B. Co.	32.6	41.8
Submarine T. B. No. 19	Fore River S. B. Co.	31.7	41.3
COLLIERS.			
Vestal	Navy Yard, New York	89.1	92.8
Prometheus	Navy Yard, Mare Island	66.8	71.5
TUG BOATS.			
Patapsco	Navy Yard, Portsmouth	75.0	76.0
Patuxent	Navy Yard, Norfolk	72.2	78.0

*Delivered at Navy Yard, Boston, July 27, 1908.

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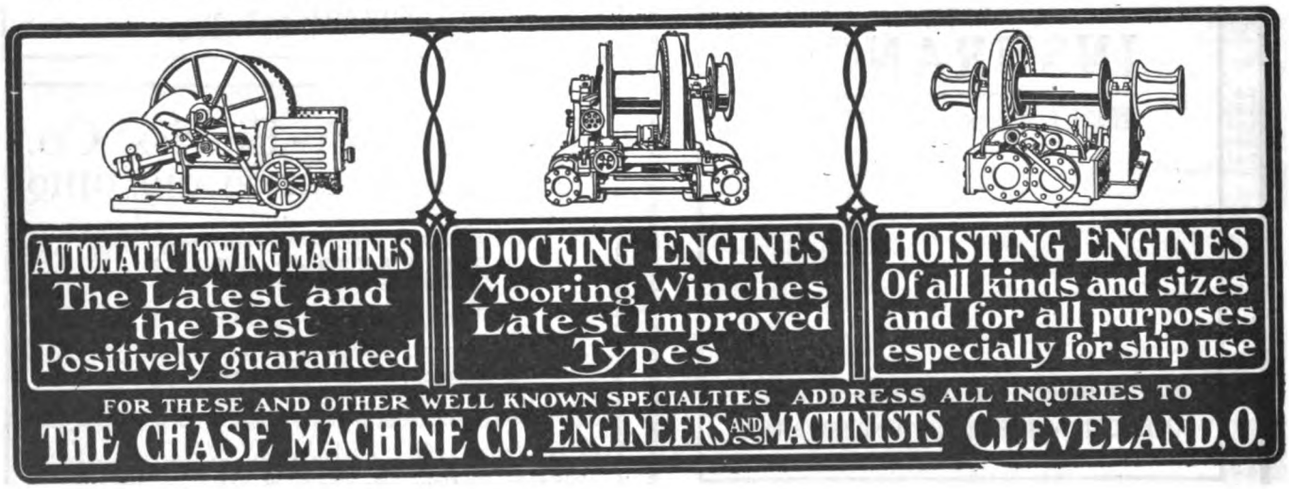
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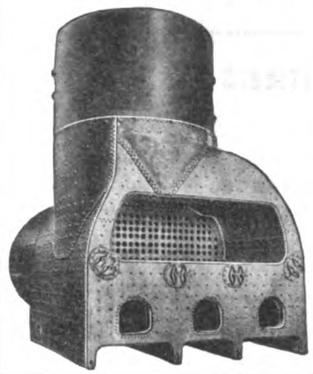

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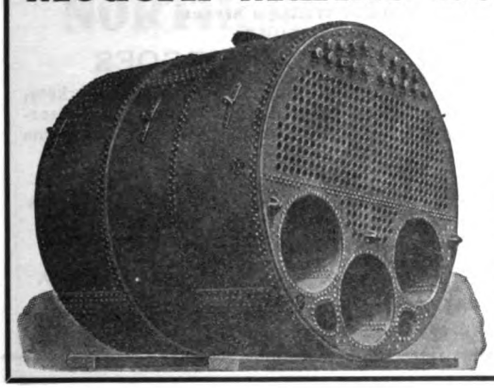

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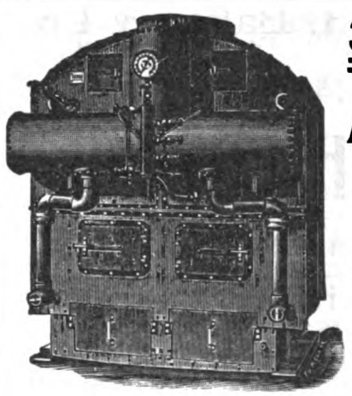

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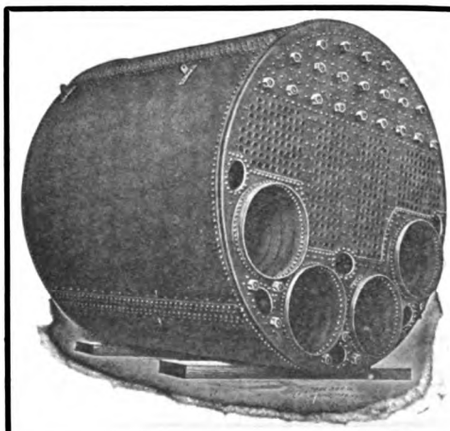

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